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Umbilical Stoma: A Classical but New Concept

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Abstract

Today, surgeons almost always create a stoma through a left or right rectus muscle-splitting incision to avoid placement at the midline laparotomy wound of patients. In the past, some surgeons preferred to create a colostomy in the umbilicus, but the practice did not gain general acceptance and the umbilicus had been regarded as a site to avoid for stoma creation. However, this attitude has recently changed in the field of pediatric surgery and adult laparoscopic surgery. The umbilical site has been used for temporary colostomies for neonates or infants with anorectal malformation or Hirschsprung's disease. Further, umbilical diverting loop ileostomies have been developed to prevent leakage in adult patients undergoing laparoscopic colorectal surgery, whose umbilicus had already been open at the time of the bowel extraction. These reports indicate the umbilical stoma is feasible, safe and cosmetically superior when reversed.

Here we review the history of stoma creation and recent utilization of the umbilical stoma and provide a brief discussion on future perspectives.

Keywords: Umbilical stoma; Surgical stoma; colostomy

Abbreviations: HD: Hirschsprung's Disease; IA: Imperforated Anus; CS: colostomy; NE: Necrotizing Enterocolitis; MI: Meconium Ileus; Vol: Volvulus; IS: Ileostomy; JS: Jejunostomy; ARM: Anorectal Malformation (recto-urethral bulbar fistula and recto-vestibular fistula); RC: Rectal Cancer; Rad: Rectal Adenoma; FAP: Familial Adenomatous Polyposis; UC: Ulcerative Colitis; Cperf: Colonoscopic Perforation; Dive: Diverticula mass.

Introduction

Stoma site significantly affects the postoperative quality of life of patients undergoing enterostomy and is the prime concern for surgeons treating gastroenterological diseases. Today surgeons almost always create the stoma through a left

or right rectus muscle-splitting incision to avoid placement at the midline laparotomy wound. This is due to the umbilicus being located in the center of the long midline laparotomy, which poses significant difficulties in pouching and management. The optimal stoma site is considered to be one that meets the following conditions in accordance with the Cleveland Criteria: below the umbilicus; within the rectus muscle; away from scars, creases, bony prominences, umbilicus, and belt line; on the summit of the infraumbilical fat mound; and visible to the patient [1]. In the past, some surgeons in the past preferred to create the colostomy in the umbilicus [2-4], but the practice did not gain general acceptance and the umbilicus has generally been regarded as a site to avoid for stoma creation.

Recently, the clinical benefits of an umbilical stoma for urinary diversion have been reported in the fields of urology, where it has been used for cutaneous ureterostomy in patients with an inadequate ureter length or for those with a high risk of urinary tract cancer recurrence [5,6]. Further, the situation has been changing in the field of pediatric surgery or adult laparoscopic surgery: the umbilical site has been used for temporary colostomy in neonates or infants with anorectal malformation or Hirschsprung's disease [7,8]. In addition, the umbilical diverting loop ileostomy is created to prevent leakage in adult patients undergoing laparoscopic colorectal surgery [9-14]. The umbilical stoma has been shown to be feasible, safe and cosmetically superior when reversed.

Here, we review the umbilical stoma and highlight this "old" concept, which was not commonly accepted up until the last decade and is now regarded as a "new" concept.

At the dawn of the umbilical stoma

Although the first umbilical stoma was recorded in 1750, most surgeons of this era preferred siting a permanent stoma in the left lower quadrant of the abdomen after the rectum had been excised, like the practice of modern-day surgeons [11]. In 1928, Paul H.T. Thorlakson, who had worked for the Maclean-Thorlakson Clinic in Winnipeg, Canada, used the excised umbilicus as the site of colonic stomas after abdominoperineal excision [2,15]. He later became the president and founder of the Winnipeg Clinic. Surgeons at the

Winnipeg Clinic preferred to create an umbilical single-barreled colonic stoma [2]. Although the umbilical stoma was reported in another article, in which a stoma was created by a transverse abdominal incision, the concept did not gain universal acceptance [16].

The first article that described the umbilical stoma was written by Robert H. Thorlakson, the son of Paul H.T. Thorlakson, in 1964 [2]. He advocated the merits of this type of stoma as follows: 1) the stoma can be made easily and quickly; 2) herniation and strangulation of the small bowel seldom occur; and 3) the stoma is easily managed by an obese patient, who may have difficulty seeing and cleaning a stoma located in the lower left quadrant, especially when standing. After a long paramedian incision was made at 2 to 2.5 inches clear of the umbilicus, the top of the sigmoid colon was divided followed by rectal extraction. The skin of the umbilicus was excised, and the proximal sigmoid colon was pulled through the defect of the umbilical site. The end colostomy was fashioned by suturing the intestine to the skin edge. Thorlakson preferred creating a flush stoma because this generated less mucus and bleeding. In his review of 150 patients over 20 years, 2 patients had prolapse, 3 had herniation, 1 had small bowel obstruction, 1 had subcutaneous abscess formation 3 years postoperatively, and 1 had gangrene of the stoma necessitating early surgical revision. The conclusion of the review was encouraging and suggested that the umbilical colostomy was particularly suitable for obese patients owing to less herniation and less prolapse.

Raza et al. similarly reported "extremely good" results for the umbilical end colostomy. They performed 106 cases of the umbilical stoma over 7 years, 101 of which were reviewed [3]. The surgery was performed via a left paramedian incision and the circular skin of the umbilicus was excised. The end colostomy was delivered through the incision, and primary maturation of the mucosa to the dermal layer was achieved with interrupted sutures. Raza et al. strongly supported the practice of this type of stoma because of the low incidence of associated complications: only four patients required re-operation because of retraction, necrosis, or parastomal evisceration (of the small bowel or omentum). Further, no patient had a parastomal hernia or prolapse, which was significant because, at the time, the high occurrence rate of parastomal hernia was the primary concern of surgeons who created stomas in the conventional fashion (at the left-lower quadrant). Raza et al. speculated that the lower risk of parastomal hernia was attributable to the strong tissue, including the rectus sheath and muscle, which surrounds the stoma at the umbilicus and provides additional strength that prevents hernia formation.

The greatest supporter of the umbilical stoma was Rupert B. Turnbull Jr., a great colonic and rectal surgeon, who was well known for enterostomal therapy [4,17]. In his textbook, Turnbull advocated that midline transumbilical end colostomy effectively reduces the incidence of parastomal hernia and prolapse of the colostomy. Moreover, he described tips for preventing small bowel obstruction in the left abdominal gutter through use of the umbilical colostomy, which often

occurred in left-side colostomy. In this procedure, the descending colon and mesentery were dissected free from the left kidney and over the ligament of Treitz. This allowed the duodenojejunal flexure and the entire small intestine to lie caudal to the umbilical colostomy. As a result, there was no longer a space in the left gutter, thereby eliminating the possibility of small bowel obstruction. As mentioned earlier, parastomal hernia often occurs in the location of the rectus and occasionally requires re-establishment of the stoma. In his text book, Turnbull commented that "this is why the Almighty created the umbilicus" [18]; the umbilicus was therefore the preferred back-up for stoma recreation. There was no specific advocacy for the umbilicus as a site of ileostomy; in Turnbull's article, the ileostomy site of choice was the right rectus position [17].

A new era of the umbilical stoma

In 1980's, the use of the umbilicus as a stoma site had been sidelined in adult surgery; however, it attracted much attention in pediatric surgery involving neonates and infants. Cameron et al. performed temporal loop/divided umbilical colostomies for patients with Hirschsprung's disease or a high imperforated anus accompanied by rectourethral fistula [19]. For children, the unsightly scar formed by a previous stoma often caused psychological distress with age, and the favorable surgical results after definitive surgery were forgotten. Therefore, Cameron et al. aimed to achieve cosmetically superior surgical scars and selected the umbilicus as a temporary stoma site because the resulting scar closely resembled a normal umbilicus long after colostomy closure. However, they considered that the umbilicus would be undesirable as a permanent stoma for children because of the psychological effect of losing the umbilicus. Later, Fitzgerald, who is Cameron's colleague, along with others, reported their 47 cases of umbilical stoma for not only temporal colostomies but also temporal ileostomies or jejunostomies over a period of 13 years [20]. In newborns, they made a circumferential skin incision; in older children, the skin of the umbilicus was not resected but was raised as a pedicled flap, which was attached to the lateral side of the serosa of the stoma and replaced at closure. Three patients died and 33 of the remaining 44 patients had their stoma reversed after a period of 14 months to 8 years. The scar of the ostomy closure resembled a relatively normal umbilicus (**Table 1**).

Transumbilical laparotomy has been used for a broad spectrum of abdominal pathologies in infants since Tan et al. reported the use of a circumferential incision of the umbilicus for pyloromyotomy in 1986 [21]. Since infants have a limited longitudinal axis and a relatively thin and elastic abdominal wall, a number of procedure performed via the umbilicus were proportionally large compared with that in adults, even after the invention of laparoscopic surgery [7]. Sauer et al. described surgical treatment of Hirschsprung's disease through a small umbilical incision. The surgical requirements of the disease are total colonic biopsy for determining the transition zone, mobilization of the colon and a transanal pull-through procedure. They performed the entire procedure via the umbilical incision, with the stoma being created at the

umbilicus for both colostomy and ileostomy [22]. Hamada et al. reported 7 cases of anorectal malformation that were treated with the transumbilical approach in umbilical sigmoid or transverse loop colostomy. In these cases, the umbilical skin was removed circumferentially; when the stomas were reversed, the umbilicus was recreated and resembled a normal umbilicus [8]. Yang et al. also reported transumbilical colostomy as the first stage of surgery for high anorectal malformation [23]. Twenty patients underwent divided double-barreled sigmoid colostomy followed by laparoscopic-assisted anorectoplasty several months later. As a result of abovementioned studies, an increasing number of surgical procedures are now being performed via an umbilical incision

in children, with a stoma being created in the same place if needed. Besides its cosmetic superiority and reduced psychological impact after reversal, another advantage of the umbilical stoma in neonates and infants is the reduced cost due to lower complication rates. In the last decade, the management of Hirschsprung's disease has evolved from a staged procedure to a single stage transanal pull through. However, since disease presentation is generally late in developing countries, staged procedures remain the standard of care. The safety and low cost of a procedure are especially relevant in these areas; therefore, the safety and feasibility of the umbilical stoma could remain predominant [24,25].

Table 1 Recent reports on umbilical stoma.

		Number of cases	Nature of the primary disease	Type of the stoma	Laparoscopic surgery	Stoma reversal (%)	Notes
Children	Canmeron et al. [19]	7	HD, IA,	CS		100	
	Fitzgerald et al. [20]	47	HD, IA, NE, MI, Vol	CS, IS, JS		75	Three patients with necrotizing enterocolitis died.
	Sauer et al. [22]	6	HD	CS, IS		67	One patient died of sepsis.
	Hamada et al. [8]	7	ARM	CS		71	One patient had mucosal prorapse.
	Yang et al. [23]	20	ARM	CS		100	No stoma related complication
Adult	Seou-En et al. [9]	4	RC, Rad, FAP, UC	IS	○	100	One patient had a minor skin rash.
	Mushaya et al. [11]	10	RC, UC, Cperf, Dive	ISEnd IS in three)	○	30	Two had persistent minor skin irritation
	Eto et al. [12]	47	RC	IS	○	87	Compared to conventional loop ileostomy
	Ishiguro et al. [13]	4	RC	IS	○	100	Obese-overweight patients

New indications of the umbilical stoma for adults in the era of laparoscopic surgery

The umbilicus had primarily been avoided as a stoma site because it marks the center of long midline laparotomy wounds. However, with the advent of laparoscopic surgery, the long midline scar is no longer a feature. Since Hasson introduced the open method of port insertion for laparoscopic procedures about three decades ago, the umbilicus has often been used as a camera port from which the specimen is extracted with an additional small incision [26]. The creation of a defunctioning stoma at the small umbilical incision removes the need for additional laparotomy, resulting in shorter operating times.

Seou-En et al. reported 4 cases of umbilical ileostomy for fecal diversion after laparoscopic surgery for the lower rectum [9]. The median duration of the stoma was 26 days (range 20-81 days), with only a mild skin rash affecting one patient. All the umbilical stomas were closed. There were no difficulties in stoma care with the use of the stomahesive wafer and supervision by an experienced stoma therapist. The authors

stated that the umbilical stoma has a cosmetic advantage and is preferable for fecal diversion following laparoscopic surgery.

Eto et al. reported 10 cases of transumbilical defunctioning ileostomy (TDI) after laparoscopic low anterior resection for rectal cancer [10]. They created the stoma to prevent anastomotic leak. An incision of 4 to 7 cm was created at the umbilicus, where the stoma was made, for extracting the tumor. They compared these patients with 10 other who received conventional defunctioning ileostomy (CDI) in the right iliac fossa for operative time, blood loss, length of hospital stays and complications in both the initial and stoma closure surgery. They found no difference in the examined factors except for the cosmetic outcome. As the umbilicus was removed circumferentially, they applied an artificial dermis to cover the revealed area at reversal. The authors also reported their latest experiences of TDI in up to 47 cases [12]. Of note, when compared with 24 cases of CDI, the rate of complications, such as wound infection and bowel obstruction after closure, was significantly lower in the TDI group than in the CDI group.

Mushaya et al. described the creation of a temporary diverting ileostomy via the umbilicus after laparoscopic surgery in 10 Western patients, 4 of whom had malignant disease and 6 had benign pathology [11]. The umbilical stoma was created by a vertical skin incision just below the umbilicus. Mushaya et al. created a 2-cm spout stoma with eversion of the afferent limb to enable patients to see their stoma with ease. At outpatient clinics, peristomal skin irritation was the most common complication, but was easily solved by stomal therapy nurses with the use of seals, a belt and a convex appliance. Stoma reversal was performed for 3 patients without any complications. The authors deemed this approach to be superior as it required one less incision and achieved good cosmesis after closure.

Another report of the preliminary results of diverting umbilical ileostomy described the benefits after laparoscopic rectal cancer surgery in obese patients [13]. Since obesity is a major risk factor for anastomotic leak after rectal cancer surgery, obese patients undergoing rectal resection often receive a diverting stoma. Creating an ileostomy in obese patients is challenging because of the high rate of stoma-related complications and the lack of an optimal approach for stoma creation for obese patients. The authors recommended umbilical ileostomy as a potential approach. Protruding umbilical ileostomies were easily created in four overweight/obese patients, and no severe stoma-related complications were encountered during their stoma periods. Mushaya et al. also adopted an umbilical stoma in a patient with body mass index of 33 kg/m² [14]. The patient did not experience daytime or nocturnal leakage and the stoma was reversed uneventfully.

There have been various points of discussion surrounding the umbilical stoma. One involves the need for wound, ostomy and continence (WOC) nurses for the management of umbilical ileostomy. Peristomal skin changes caused by leakage often make maintenance of the stoma difficult. Although their experience was sparse in the beginning, the involvement of WOC nurses has been deemed mandatory for maintenance of the umbilical stoma because the repeated observation and appropriate utilization of stomal appliances are the key to successful stoma management. Intervention by WOC nurses has been reported to significantly improve the discoloration, erosion, and tissue overgrowth around the stomas [12]. Another point of discussion involves the unconfirmed long-term outcome of the stoma; that is, it is unclear whether the umbilical stoma is suitable as a permanent stoma [12,13]. A substantial portion of the patients with a diverting stoma cannot have their stoma closed [27]. Therefore, selection of suitable patients for this stoma should be made a priority after the accumulation of appropriate evidence in the future.

Conclusion

We reviewed the history of stoma creation and recent utilization of the umbilical stoma and provide a brief discussion. Transumbilical single-incision laparoscopic surgery is a modern technique for laparoscopic surgery in both children and adults [28,29], that offers remarkable cosmetic

benefits leaving only a single small scar that is virtually concealed within the umbilicus [30]. Even in cases where temporal fecal diversion is required in the surgery, the location of the stoma in the single umbilicus wound can support a near-scarless outcome. Therefore, the umbilicus has played a central role in the era of laparoscopic surgery. Although small case series has been reported so far yet and further investigation is required to establish the indications for umbilical stoma and to assess its long-term outcome, the stoma could also continue to play a central role in the future.

Conflicts of Interest

We declare that there are no conflicts of interest.

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