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Stoma Bridge Types and Their Impact on Patient Outcomes

A Retrospective Analysis and Prospective Global Survey of Surgical Practice

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ABSTRACT

PURPOSE: The purpose of this study was to describe the effect of rigid or flexible stoma bridges used for loop ostomy diversions on peristomal skin integrity. Additional aims were to describe surgeon practices related to stoma bridges, and determine the availability of an ostomy nurse specialist.

DESIGN: Retrospective chart review and cross-sectional survey.

SAMPLE AND SETTING: The sample used to address the first aim (effect of stoma bridges) comprised 93 adult patients cared for at Morristown Medical Center, Atlantic Health System, Morristown, New Jersey, an acute care facility. Data provided by 355 colorectal surgeons from 30 countries were used to describe surgeon practice in this area and determine the availability of an ostomy nurse specialist. Respondents were invited from an international roster of colorectal surgeons obtained with permission from the American Society of Colon and Rectal Surgeons (ASCRS).

METHODS: In order to accomplish the initial aim, we retrospectively reviewed medical records of patients who underwent ostomy surgery from 2008 to 2015 and met inclusion criteria. In order to meet our additional aims, analyzed data were obtained from a survey of colorectal surgeons that queried practices related to stoma bridges, and availability of an ostomy nurse specialist.

RESULTS: Patients managed with a rigid bridge were significantly more likely to experience leakage beneath the pouching system faceplate than were patients managed by a flexible bridge (42% vs 11%, $P < .001$). Slightly less than one quarter of patients who developed leakage (n = 22, 24%) experienced pressure and moisture-related peristomal skin complications. Peristomal wounds, inflammation, and infection were significantly higher when a rigid bridge was used (χ^2 test, $P < .003$). The surgeon's survey (N = 355) showed variability in the use of bridges. Ninety-three percent of all surgeons indicated an ostomy nurse specialist was part of their health care team.

CONCLUSIONS: Rigid ostomy bridges were associated with a higher likelihood of leakage from underneath the faceplate of the pouching system and impaired peristomal skin integrity. Analysis of colorectal surgeon responses to a survey indicated no clear consensus related to bridge use in patients undergoing loop ostomies.

KEY WORDS: Colostomy, Complications, Ileostomy, Loop ostomy, Ostomy, Stoma bridge.

INTRODUCTION

Protective loop ileostomies and colostomies are often created in patients with acute or complex surgical conditions involving the bowel such as intestinal perforation, inflammatory stenosis, neoplastic obstruction, and complex anorectal injuries or fistulas. An estimated 120,000 ostomies are performed each year in the United States.[1,2] Historically, surgeons have used a number of methods such as a rigid bridge or other devices to temporarily support the loop of bowel on the abdominal wall, allowing sufficient time for it to adhere to the skin's surface.[3] Nevertheless, our experience suggests that consensus regarding use of a bridge is lacking. We have also observed that techniques for use of a supportive bridge, along with the type of bridge employed, are left up to the discretion of the surgeon.

Supportive devices, either rigid bridges or flexible catheters, are sometimes sutured to the skin and remain in place for 5 to 7 days. Characteristics of rigid bridges, in particular, create challenges when fitting the individual with an ostomy pouching system. Limited evidence suggests that a rigid bridge may impair adherence of the adhesive faceplate of an ostomy pouching system, resulting in undermining and leakage of effluent onto the peristomal skin.[4] Exposure of the peristomal skin to effluent may lead to complications such as peristomal moisture-associated skin damage, infection, and other forms of skin damage that negatively affect the patient's health-related

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quality of life.[5-10] Nichols[10] links the condition of the peristomal skin to health; he analyzed responses from 15,591 persons with ostomies and reported that severe peristomal skin compromise negatively impacts social activities leading to social isolation. Furthermore, maintaining integrity of the peristomal tissue improves health-related quality of health.

In addition to the inability to achieve secure pouch adherence, the presence of a rigid bridge may cause tension on the surrounding tissue, resulting in intestinal erosion and necrosis.[11,12] Surgeons have expressed dissatisfaction with rigid bridges, as evidenced by the large number of published alternative techniques to prevent stoma retraction.[13-15] In addition, findings from several studies suggest that bridge support devices are unnecessary.[16-18]

Although the use of rigid bridges and associated complications are well described, we searched the literature and found no comparative studies of complications among the various techniques used to prevent stoma retraction. In addition, despite the high frequency of loop ostomy creation in surgical practice, consensus concerning best practice when using a bridge following loop ostomy surgery is lacking.[1] Surgeons, therefore, tend to rely on past experience when creating and supporting loop ostomies.[19] The purpose of this study was to explore the effect of rigid or flexible stoma bridges on peristomal skin integrity, including effluent leakage. Additionally, we surveyed an international group of colorectal surgeons to describe practices related to stoma bridges, and availability of an ostomy nurse specialist.

METHODS

We employed 2 designs to meet study aims. First, we completed a retrospective review of medical records to describe the effects of use of rigid bridges or flexible catheters on the peristomal skin. Second, we created an electronic survey to describe use of rigid bridges or flexible catheters in patients undergoing loop ileostomy or colostomy. The survey also queried the availability of an ostomy nurse specialist when delivering care to these patients. A description of study procedures, including the retrospective chart review and cross-sectional survey, was reviewed by the Atlantic Health System IRB who determined the study did not require individual informed consent.

Aim 1: Retrospective Review of Medical Records

An interdisciplinary research team was established that reviewed the literature about best practices related to skin care and stomas. The team reviewed and collectively approved the study design, population, data collection plan, and process to maintain confidentiality. Data were collected via an electronic spreadsheet designed by the investigators for purposes of this study. Data collectors underwent structured training to ensure consistent data entry and coding. Inclusion criteria for the first study aim were adults undergoing a surgical loop ileostomy or loop colostomy procedure, between 2008 and 2015.

The study setting was Morristown Medical Center, an academic community medical center located in a suburban setting of Morristown, New Jersey, in the northeastern United States. The facility has been designated as an ANCC Magnet® facility since 2001, and is 1 of 5 hospitals in the Atlantic Health System. Potential records were initially selected for review based on inclusion criteria and the *International Classification of Diseases, Ninth Revision*, and the *International Classification of Diseases, Tenth Revision,* codes. The retrospective review was performed by 3 team members: the principal investigator (T.M.T.), a surgical resident (J.L.), and a nurse practitioner (S.P.). Data were verified by the principal investigator.

After eligibility was confirmed, study variables were entered into the spreadsheet. Data collectors extracted demographic data (age, gender, height, weight, and body mass index [BMI]) and pertinent clinical variables (diagnoses, type of ostomy, surgeon specialty, adjuvant therapy such as chemotherapy, type of stabilization device, suturing of the device, and hospital length of stay). Outcome variables collected from medical review were peristomal skin status, ostomy barrier leakage, and number of WOC nurse visits for skin-related complications. For the purposes of this study, impaired peristomal skin integrity was operationally defined as erythema, loss of peristomal skin integrity, and infection of the skin immediately adjacent to the stoma and covered by the individual's pouching system. The principal investigator verified all data for accuracy.

Aim 2: Cross-sectional Survey of Surgical Practice

An electronic survey was distributed in collaboration with the American Society of Colon and Rectal Surgeons (ASCRS). The survey was disseminated by the ASCRS leadership to 3000 national and international members.

Survey questions were created by an interdisciplinary research team based on gaps in the literature. Demographic items queried the country where respondents practiced, postgraduate specialty education, and years of practice, type of facility, type of bridge used, use of sutures, opinion regarding use of bridge related to retraction, average number of days the bridge remained in place, and availability of an ostomy nurse specialist. Anonymous data were received from the ASCRS in the form of a spreadsheet and analyzed using Minitab® Statistical Software, version 17 (IBM, Armonk, New York). The survey comprised 10 items and required approximately 10 minutes to complete. An invitation to complete the questionnaire was sent once to surgeons on the ASCRS membership database; no additional invitations were sent.

Data Analysis

Data from the retrospective medical record review were summarized using descriptive statistics, count and percent, mean, and standard deviation, or median and range were used as appropriate to profile the data from the retrospective chart review as well as to analyze the physician survey. Univariate analysis (2-sample t test, Mann-Whitney, 2 proportions test, χ^2 test for independence, or Fisher exact test) was performed with each predictor variable to evaluate level of statistical prediction related to bridge-related peristomal skin complications. A P value less than .1 was used to determine which variables would be included in multivariate analysis. These variables were age, gender, BMI, surgeon specialty, ostomy type, type of device, and suturing of device. Multivariate logistic regression was then used to identify associations between bridge-related peristomal skin complications and independent variables entered into multivariate analysis. Data from the survey were analyzed via descriptive. Univariate analysis comprised χ^2 and Fisher exact tests.

RESULTS

In order to address Aim 1, we reviewed the medical records of 93 patients who met inclusion criteria; this group represented approximately 25% of all surgical ostomy procedures. Of these, 38 were managed by a rigid bridge, 54 by a flexible catheter, and 1 received no bridge device. No significant differences were found among demographic characteristics between individuals

TABLE 1.
Retrospective Medical Record Review: Demographic Data

Variables	Flexible, n = 54	Rigid Plastic, n = 38	No Bridge, n = 1	Total, n = 93
Gender				
Male, n (%)	21 (39)	18 (47)	1 (100)	40 (43)
Female, n (%)	33 (61)	20 (53)	0 (0)	53 (57)
Age, y				
Mean ± SD	58.07 ± 17.74	61.82 ± 14.66	58	59.6 ± 16.47
Median (range)	60 (19-91)	61.5 (22-96)	58	60 (19-96)
BMI, kg/m^2				
n	53	33	1	87
Mean ± SD	24.73 ± 4.15	26.64 ± 62.36	25.09	25.47 ± 5.13
Median (range)	23.80 (14.36-36.09)	26.23 (12.69-43.04)	25.09 (25.09-25.09)	24.62 (12.69-43.04)

Abbreviations: BMI, body mass index; SD, standard deviation.

with rigid bridges and individuals with flexible catheters. There were slightly more females (n = 53) than males (n = 40). Their mean BMI (mean ± standard deviation) was 25.47 ± 5.13, median 24.62 (interquartile range 12.69-43.04; Table 1). The most frequent reason for loop ostomy diversion was cancer (n = 56, 60%), followed by inflammatory bowel disease (n = 15, 16%), and bowel obstruction (n = 9, 10%).

The type of surgeon was statistically associated with the type of device used ($P < .001$, χ^2). Colorectal surgeons (n = 45, 83%) were more likely to use a flexible catheter than were oncologic (n = 4, 7%) or general surgeons (n = 5, 9%). Of 38 rigid bridges used, most (n = 26, 68%) were sutured. Leakage from underneath the adhesive faceplate of the ostomy pouching system was more common in patients managed with rigid bridges versus flexible catheters (42% vs 11%, $P < .001$, χ^2 test; Figure 1).

Complications included discomfort, peristomal erythema, peristomal moisture-associated skin damage (irritation attributable to exposure to fecal effluent from ostomy and moisture), and infection. Six patients, with ostomy barrier leakage from rigid bridges, also had stage 2 medical device-related pressure injuries attributed to the presence of the rigid bridge[20] (Figure 2). Medical device-related pressure injuries result from use of the devices applied for monitoring, diagnosis, or treatment purposes. Medical device-related pressure injury (MDRPI) wounds were staged using the updated National Pressure Ulcer Advisory Panel Pressure Injury Staging System. We observed partial-thickness wounds MDRPI in significantly more patients using rigid bridges; no MDRPIs were observed in patients managed with flexible catheters (n = 6, 16% vs n = 0, 0%, $P = .003$, χ^2; Table 2). In addition, patients with rigid bridges (n = 13, 34%) required a higher proportion of ostomy nurse visits during hospitalization than did patients with flexible catheters (n = 5, 9%) ($P = .004$, 2 proportions test).

Aim 2: Surgeon Practice and WOC Nurse Availability

Three hundred fifty-five of 3000 surgeons responded to the electronic survey, providing a response rate of 12%. The surgeons indicated they practiced in 30 countries, representing 5 continents. Most reside in North America (n = 301, 84%), followed by Australia, Asia, and Europe. Most surgeons practiced in community settings (n = 164, 46.19%), followed closely by academic settings (n = 150, 42.25%). One-third (34.65%) of respondents had 20 years or more experience. The vast majority identified as colorectal surgeons (n = 340, 96%; Table 3).

Colorectal surgeons (n = 340) reported using rigid bridges (n = 113, 33.24%) more frequently than flexible catheters (n = 88, 25.88%). A minority of colorectal surgeons (n = 20, 5.88%) used both types. No differences were noted when we compared bridge use in academic versus community-based hospitals (67.39% vs 66.16%, $P = .799$, 2 proportions test). Surgeons in US military settings used significantly fewer bridges or flexible catheters than surgeons in academic and/or community settings.

Figure 1. Peristomal moisture-associated skin damage.

Figure 2. Pressure injuries related to rigid bridge.

TABLE 2.
Retrospective Chart Findings

Variables	Flexible Catheter, n = 54, n (%)	Rigid Plastic, n = 38, n (%)	No Bridge, n = 1, n (%)	*P* Value
Principal surgeon specialty				
Colorectal	45 (83)	12 (32)	0	<.001; χ^2
Oncology	4 (7)	15 (39)	0	
General	5 (9)	11 (29)	1 (100)	
Ostomy type				
Loop ileostomy	48 (89)	23 (61)	1 (100)	.001; χ^2
Loop colostomy	6 (11)	15 (39)	0	
Bridge sutured to skin				
Yes	0	26 (68)	0	<.001; Pearson χ^2
No	54 (100)	12 (32)	0	
n/a	0	0	1 (100)	
Ostomy barrier leakage due to bridge (inpatient)	6 (11)	16 (42)	0	<.001; χ^2
Yes	48 (89)	22 (58)	1 (100)	
No				
Bridge-related wound[a]				
Yes				<.003; χ^2
No	0	6 (16)		
n/a	54 (100)	32 (84)	1 (100)	
Other skin complications (no wound)				
Discomfort	1 (2)	8 (21)	0	

[a]Partial-thickness wound.
Abbreviation: n/a, not available.

No association was found when we compared years of surgical practice to bridge use ($P < .073$, χ^2). Analyzing use of rigid bridge, flexible catheter, both, or neither, there was an association with years of practice ($P = .025$, χ^2). Years of practice was associated with type of bridge used, or not using any bridge. Surgeons with less than 5 years of practice had a higher-than-expected use of flexible catheters. Surgeons with 6 to 10, or 11 to 20 years of practice did not use any device, and this was observed at a higher-than-expected rate. Surgeons with more than 20 years of practice used rigid bridges, or used both types of bridges, more frequently than expected. Surgeons using either a rigid bridge or flexible catheter (n = 230) were asked to indicate the range of days a bridge device is likely to remain in place. Most stated that devices remained in place from 1 to 5 days (n = 116; 50.4%), from 6 to 10 days (n = 67; 29.1%), 11 to 15 days (n = 36; 15.7%), and greater than 15 days (n = 11; 4.8%).

DISCUSSION

Findings indicate that patients undergoing loop ostomy creation are at risk for both early and late peristomal skin complications (discomfort, peristomal erythema, irritant dermatitis, and infection), as well as challenges securing a barrier seal. Use of a rigid bridge increases the risk for complications. We found limited evidence concerning the advantages and disadvantages of stoma loop bridge use (ie, rigid bridge vs flexible catheters, to prevent stoma retraction in loop ileostomy or loop colostomy stomas). For example, we found minimal evidence related to use of a rigid bridge to prevent stoma retraction.[17,21] Speirs and colleagues[16] reported findings from a randomized controlled trial of 117 patients (n = 58 bridge; n = 59 no bridge) comparing use of a bridge for prevention of stoma retraction following loop ileostomy. They found that stoma retraction was uncommon and no differences in occurrences when a bridge was employed. Their findings are similar to Whiteley and associates,[18] who retrospectively reviewed 515 medical records.

We also found that patients managed with a rigid bridge were significantly more likely to experience peristomal skin complications than were patients managed with a flexible catheter ($P = .001$). Rigid bridges lie on the skin surface and are often sutured in place. The time the bridge remains in place varies; the duration of use is at the discretion of the surgeon. Cross-sectional data from 355 surgeons indicate that rigid bridges are used for 1 to 5 days, and some indicated leaving a bridge in place for as long as 15 days. Our retrospective medical record review did not measure the length of time a rigid bridge or flexible catheter remained in place.

We found that patients with rigid bridges required a higher proportion of ostomy nurse visits during hospitalization than for patients with flexible catheters ($P = .004$). Management of stomas with a supporting rigid bridge can be challenging because the ostomy pouching system must be tailored to incorporate the bridge. Inability to create an optimal barrier seal due to the rigid bridge causes leakage and the effluent coming in contact with the peristomal skin. Repetitive pouching in an attempt to contain effluent may result in mechanical stripping and epidermal damage to the skin. Prolonged skin exposure to effluent further compromises the skin, resulting in erosion, dermatitis, and infection as well as the risk of injury to the bowel wall from the bridge itself.[6,11]

Previous researchers have reported skin complications when a bridge was present.[12,16,17] Oh and colleagues[17] as well

TABLE 3.
Survey Respondent Characteristics (N = 355)

Survey Variables	n (%)
Participant country	
North America	302 (85.00)
Asia	16 (4.51)
Australia	6 (1.69)
Europe	16 (4.50)
South America/Central America	10 (2.82)
Missing	5 (1.40)
Years in practice	
≤5 y	69 (19.44)
6-10 y	68 (19.15)
11-20 y	93 (26.20)
>20 y	123 (34.65)
No response	2 (0.56)
Postgraduate training	
Colon and rectal surgery	340 (95.77)
Surgical oncology	20 (5.63)
Advanced laparoscopic and endoscopic surgery	24 (6.76)
None of the above	10 (2.82)
Type of bridge used	
Rigid Plastic	116 (32.68)
Flexible catheter	92 (25.92)
Both	22 (6.20)
Neither	125 (35.21)

as Speirs' group[16] opined that a loop ileostomy, properly constructed, does not require routine use of a bridge device. Furthermore, Oh and colleagues[17] indicated that leakage and difficulty with placement of a stoma appliance when a bridge is present may result in physical and psychological distress. Zindel and associates[12] investigated the effect of a stoma rod on loop ileostomies and found that its use significantly increased the incidence of local complications such as stoma necrosis.

Surgeon Practice

Findings from the cross-sectional survey showed variability between surgeons concerning use and selection of a rigid versus flexible bridge. We also found variability in the time the bridge was left in place. These findings support the need for additional evidence-based research to identify best practices related to peristomal complications and patient outcomes. Years in practice did not influence use or type of bridge. These findings suggest surgical procedures may be based on traditional training/education rather than evidence-based practice.

Limitations

Patient data are based on a retrospective review of 93 medical records cared for in a single facility. The length of time each device was left in place was not addressed in the retrospective study, which is a limitation. A larger, prospective random sample from multiple institutions is recommended to include broader patient types, and consequently strengthen the findings. Finally, elective versus emergent cases were not differentiated; additional research is needed to determine the influence of this factor on peristomal skin complications in patients undergoing loop ostomy.

CONCLUSIONS

The results of this study suggest that use of a rigid bridge following loop ostomy creation impairs peristomal skin health. Moreover, our study showed more ostomy nurse specialist visits are required to intervene when complications are present.

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