SPECIAL ARTICLE

Outcomes of Ostomy Procedures in Patients Aged 70 Years and Older

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Hypothesis: Patients aged 70 years and older undergo proportionately more emergency and permanent fecal ostomy procedures than younger patients. Older patients have comparable short-term outcomes in morbidity and mortality, with adverse outcomes dependent on comorbid conditions and timing of the procedure rather than age alone. Older patients should be treated similarly to younger patients in terms of subsequent ostomy takedown, if an acceptable operative risk.

Design: A retrospective review of our facility's experience with fecal ostomies between 1992 and 2002 was performed to determine the effect of advanced age on surgical outcome measures.

Setting: A tertiary managed care medical center.

Patients: Three hundred eighty-three consecutive patients who underwent new fecal ostomy procedures between October 1, 1992, and October 1, 2002. One hundred three patients were aged 70 years or older (mean age, 76.4 years), and 280 patients were younger than 70 years (mean age, 49.6 years). There were 220 elective procedures and 163 emergency procedures. Outcome was analyzed between the 2 age groups.

Main Outcome Measures: Indications for ostomy, type of ostomy, preoperative comorbidity, postoperative morbidity and mortality, length of intensive care unit and hospital stay, and subsequent ostomy takedown success.

Results: Three hundred eighty-three new fecal ostomies were created. The diagnosis leading to creation of the ostomy was more often malignancy in older patients (74.8%) compared with younger patients (45.0%). Both age groups underwent a similar proportion of emergency procedures (older vs younger patients, 43.7% vs 42.1%; $P=.07$), but more older patients were left with permanent stomas (59.2% vs 41.1%, $P=.002$). Older patients also had more preoperative comorbidities ($P=.001$), higher American Society of Anesthesiologists scores ($P=.001$), longer hospital stays ($P=.04$), and more postoperative complications. Thirty-day mortality was 6.8% in the older group vs 0.4% in the younger group ($P=.001$). Fewer older patients were eligible for ostomy reversal (41.1% vs 59.2%), and a smaller proportion of eligible older patients actually underwent the reversal procedure (78.7% vs 95.2%). The complication rate associated with ostomy reversal was not significantly different in the 2 age groups ($P=.002$).

Conclusions: Patients aged 70 and older undergo proportionately more permanent fecal ostomy procedures than younger patients, with longer hospital stays, more postoperative complications, and higher mortality rates. However, surgical outcome measures in older patients following ostomy procedures remain within acceptable standards. Furthermore, older patients tolerate ostomy reversal with minimal morbidity and should not be denied consideration based on age alone if an eligible candidate.

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THE NUMBER and proportion of older patients undergoing surgical procedures are increasing as a result of increased life expectancy. A recent study[1] showed that the mean life expectancy in the United States for 80-year-old men and women was 7.0 and 9.1 years, respectively. As we allocate more resources to treating older persons, we continue to study the effect of advanced age on surgical outcome. Older persons are more likely to have significant concomitant medical diseases that increase the risk of surgery.[2-8] However, improvements in perioperative care, anesthetic techniques, and surgical procedures have permitted many operations that were once limited to younger patients to now be offered to patients of advanced age. In recent years, studies have demonstrated that age alone is not a contraindication for performing many complex surgical procedures, including (but not limited to) esophageal resection,[9] elective abdominal aortic aneurysm repair,[10] pancreaticoduodenectomy,[11] laparoscopic cholecystectomy and common bile

duct exploration,[12] laparoscopic antireflux procedures,[13,14] and modified radical mastectomy.[15]

Studies specifically evaluating the outcome of surgery for colorectal disease in older persons have demonstrated that major procedures should not be denied on the basis of age alone[8,16,17] and that colorectal surgery can be conducted with an acceptable margin of safety in older persons.[8,16-21] Surgical outcome in older patients is more dependent on the urgency of the operation and comorbid conditions than age.[5,6,19,22,23]

Fecal ostomies, including diverting and end ileostomies and colostomies, are frequently performed by general and colorectal surgeons. They are often indicated to treat gastrointestinal diseases, including malignancy, inflammatory bowel diseases (IBDs), diverticular disease, infection, perforation, and obstruction. Fecal ostomies are performed as emergency operations and as planned elective procedures. In addition, ostomies may be constructed to be permanent or may be created as a temporary diverting treatment, with a takedown procedure performed at a later date. Because of the increasing number of older patients undergoing major abdominal operations, more older patients are subject to fecal ostomies. The effect of an ostomy procedure in patients of advanced age has not been specifically studied, to our knowledge. This study evaluates the short-term surgical outcome of fecal ostomies in patients older than 70 years during 10 years. Our experience with ostomies is described, analyzing the indications and type of operation performed, preoperative and postoperative morbidity, mortality, length of hospital stay, and success of ostomy takedown procedures. Outcomes are compared between older and younger patients.

METHODS

PATIENTS

During the October 1, 1992, to October 1, 2002, study, 401 consecutive patients underwent procedures at Kaiser Permanente Medical Center in which new fecal ostomies were created. Only patients in whom a new ostomy was created were included in the study, excluding patients with previous ostomies, urinary ostomies, and revision of existing ostomies. Of the 401 patients, 18 were excluded because of the inability to obtain sufficient data, resulting in a study group of 383 patients. The excluded group included 4 patients 70 or older and 14 patients younger than 70. Medical records and operative reports were retrospectively reviewed to record patient demographics, diagnosis, preoperative comorbid conditions, operative procedure, postoperative outcome measures, and whether an ostomy reversal procedure was subsequently performed. There were 205 male and 178 female patients. One hundred three patients were 70 or older, and 280 patients were younger than 70. The mean age of the older group was 76.4 years (range, 70-97 years). The mean age of the younger group was 49.6 years (range, 14-69 years). There were 220 elective procedures and 163 emergency procedures.

PREOPERATIVE DIAGNOSIS AND URGENCY OF PROCEDURE

Diagnoses included cancer (53.0%), IBD (21.9%), diverticulitis (14.9%), obstruction (3.9%), infection (3.9%), and perforation (2.3%). Elective procedures were performed in 57.4% of patients, and emergency procedures were performed in 42.6%.

PREOPERATIVE COMORBIDITY

Significant preoperative comorbid conditions were classified as cardiovascular (coronary artery disease, congestive heart disease, valve disease, and arrhythmia), chronic obstructive pulmonary disease, diabetes mellitus, hypertension, coagulopathy, immunosuppression (including exogenous corticosteroids), cognitive impairment, or "other." Included in the "other" category were morbid obesity, renal failure, history of major stroke, and bedridden from paralysis.

INDEX OPERATION AND TYPE OF FECAL OSTOMY

Of the 383 procedures, 58.0% involved partial or complete resection of the colon, 19.1% were abdominoperineal resections, and 23.0% consisted of exploratory laparotomy without bowel resection. Procedures in which the intent of the operation was the creation of a fecal ostomy were classified as exploratory laparotomies. Fecal ostomies were classified as end or loop ileostomies or as end or loop colostomies. All procedures were performed by attending surgeons at Kaiser Permanente Medical Center, with or without the participation of a senior level surgery resident.

POSTOPERATIVE MORBIDITY AND MORTALITY

Thirty-day postoperative morbidity and mortality events were determined for each patient. Morbidity classifications included cardiovascular disease (myocardial infarction, angina, new arrhythmia, heart failure, or stroke), pulmonary failure requiring mechanical ventilation, pneumonia, coagulopathy, renal failure requiring hemodialysis, intra-abdominal sepsis, wound infection or intra-abdominal abscess, reoperation for complication, and readmission for complication. The overall 30-day mortality was 2.1%.

OSTOMY REVERSAL PROCEDURE

Fifty-four percent of patients were candidates for a subsequent ostomy reversal procedure. Patients were not considered candidates if they underwent abdominal perineal resection or if the ostomy was created for a complication of end-stage malignancy. Of the reversal candidate group, 91.8% underwent an ostomy takedown procedure. The delay between the index operation and ostomy takedown procedure was determined, as were morbidity and mortality associated with the reversal operation.

STATISTICAL ANALYSIS

Statistical analysis was carried out using χ^2 test and Fisher exact test for categorical variables and 2-sample t tests for continuous variables. Statistical significance was defined as $P<.05$. A multivariate logistic regression model in which the outcome was death and the predictors were age, American Society of Anesthesiologists (ASA) score, and number of preexisting comorbidities was performed.

RESULTS

Of the 383 patients, 103 were 70 or older and 280 were younger than 70. Patient demographic profiles and preoperative comorbidities are presented in **Table 1**, as are ASA operative risk scores. Older patients were more often fe-

male (53.4% vs 43.9%), but this was not significantly different ($P=.10$). Comorbidities were more prevalent among older patients, specifically cardiovascular disease (35.9% vs 5.0%, $P=.001$), chronic obstructive pulmonary disease (7.7% vs 2.9%, $P=.009$), diabetes mellitus (17.5% vs 7.9%, $P=.004$), hypertension (47.6% vs 20.0%, $P=.001$), coagulopathy (6.8% vs 2.9%, $P=.08$), and cognitive impairment (6.8% vs 1.1%, $P=.005$). Immunosuppression from exogenous corticosteroids or chemotherapy was more prevalent among younger patients (18.9% vs 7.8%, $P=.01$). American Society of Anesthesiologists scores were significantly higher in the older group ($P=.001$).

The condition leading to the index procedure was different between the 2 age groups, with older patients having a higher rate of cancer (74.8% vs 45.0%) and a lower rate of IBD (2.9% vs 28.9%). The type of ostomy created was also statistically different and is summarized in **Table 2**. Most patients in both age groups underwent fabrication of an end colostomy or loop ileostomy (older vs younger patients, 89.3% vs 82.2%). Eligibility for subsequent reversal of the stoma was significantly different, with only 40.8% of older patients eligible compared with 58.9% of younger patients ($P=.002$).

Of the 103 older patients who underwent ostomy procedures, the underlying cause was malignancy in 77 (74.8%). Sixty-eight of 77 patients had colorectal cancer, with 9 patients diagnosed as having a primary gynecologic malignancy (endometrial, ovarian, or cervical cancer). The index procedures performed for colorectal cancer are summarized in **Table 3**. Permanent loop ileostomies were performed in 9 patients (13.2%) to palliate advanced cases of colorectal cancer.

Surgical outcome measures are presented in **Table 4**. Of 103 older patients, 32 (31.1%) required admission to the intensive care unit (ICU) during their hospitalization, with a mean ICU stay of 5.6 days. Only 10.0% of younger patients received ICU care ($P=.001$). Patients requiring hyperalimentation with parenteral nutrition (27.2% vs 18.9%) and blood product transfusions (33.0% vs 23.9%) were similar between age groups. Postoperative complications that were significantly more prevalent among older patients included cardiovascular conditions (7.8% vs 1.1%, $P=.002$), respiratory failure (13.6% vs 2.1%, $P=.001$), and renal failure (4.9% vs 1.1%, $P=.02$). Frequency of postoperative pneumonia, sepsis, coagulopathy, stroke, and infection was not significantly different. In addition, rates for reoperation (4.9% vs 5.0%, $P=.85$) and readmission (5.8% vs 5.0%, $P=.64$) were similar. The older group experienced higher mortality (6.8% vs 0.4%, $P=.001$) and longer overall length of hospital stay (12.0 vs 10.2 days, $P=.04$). Twenty-six of 103 older patients were discharged to skilled nursing facilities, compared with only 5 of 280 younger patients.

Two hundred seven of 383 patients were eligible for stoma reversal procedures. Fewer older patients were eligible (40.8% vs 58.9%), and of the eligible patients, actual ostomy takedown procedures were less frequently performed in those patients of advanced age (78.6% vs 95.2%, $P=.002$) (**Table 5**). Of the eligible patients, 61.9% of older patients vs 58.2% of younger patients had a diverting loop ileostomy. Thirty-one percent of older patients and 30.3% of younger patients had end colostomies with distal (Hartmann) pouches. There were 9 eligible older patients who did not undergo ostomy reversal, 5 with end colostomies and 4 with loop ileostomies. In the younger age group, all but 8 eligible patients proceeded with ostomy takedown. Five of these 8 patients had end colostomies. Complication rates associated with the stoma reversal procedure were similar (6.1% vs 4.5%, $P=.66$), and there were no patient deaths associated with stoma reversal procedures.

The multivariate logistic regression model analyzing the outcome of death was not included in the study. The confidence intervals were too wide because of the small number of deaths, including only 1 death in the younger age group.

Table 1. Demographic and Comorbidity Characteristics

Characteristic	Age ≥70 y (n = 103)	Age <70 y (n = 280)	*P* Value
Age, mean (range), y	76.4 (70-97)	49.6 (14-69)	
Female/male ratio, No. (%)	55/48 (53.4/46.6)	23/157 (43.9/56.1)	.10
Comorbidity, %			
Cardioivascular	35.9	5.0	.001
COPD	7.7	2.9	.009
Diabetes mellitus	17.5	7.9	.004
Hypertension	47.6	20.0	.001
Coagulopathy	6.8	2.9	.08
Immunosuppression	7.8	18.9	.01
Cognitive impairment	6.8	1.1	.005
Other*	13.6	6.1	.02
Elective/emergency, No. (%)	58/45 (56.3/43.7)	162/118 (57.9/42.1)	.07
ASA classification, %			
I	0	6.1	.001
II	44.7	75.0	
III	48.5	17.9	
IV	5.8	1.1	
Mean score	2.6	2.1	.001

Abbreviations: ASA, American Association of Anesthesiologists; COPD, chronic obstructive pulmonary disease.
*Includes morbid obesity, renal failure, stroke, and bedridden from paralysis.

Table 2. Diagnosis and Operations

Variable	Age ≥70 y (n = 103)	Age <70 y (n = 280)	*P* Value
Diagnosis, %			
Malignancy	74.8	45.0	.001
Inflammatory bowel disease	2.9	28.9	
Diverticulitis	11.7	16.1	
Obstruction	6.8	2.9	
Perforation	2.9	2.1	
Infection	1.0	5.0	
Operation, %			
Bowel resection	44.7	62.9	.006
Abdominoperineal resection	26.2	16.1	
Exploratory laparotomy	29.1	21.1	
Type of ostomy, %			
End colostomy	49.5	41.1	.01
End ileostomy	6.8	15.0	
Loop colostomy	3.9	2.9	
Loop ileostomy	39.8	41.1	

Table 3. Older Patients With Cancer

Variable	No. (%) Aged ≥70 y (n = 77)
Primary malignancy	
Colorectal cancer	68 (88.3)
Gynecologic cancer	9 (11.7)
Procedure performed in patients with colorectal cancer	
Abdominoperineal resection	25 (36.8)
Resection with anastomosis and diverting loop ileotomy	17 (25.0)
Resection with end colostomy and distal pouch	16 (23.5)
Permanent diverting loop ileostomy	9 (13.2)
Diverting loop colostomy	1 (1.5)

Table 4. Surgical Outcome Measures

Variable	Age ≥70 y (n = 103)	Age <70 y (n = 280)	*P* Value
ICU admission, %	31.1	10.0	.001
Length of ICU stay, mean, d*	5.6	4.3	.32
Received parenteral hyperalimentation, %	27.2	18.9	.08
Received blood product transfusions, %	33.0	23.9	.09
Postoperative complications, %			
Cardiovascular	7.8	1.1	.002
Respiratory failure	13.6	2.1	.001
Pneumonia	5.8	3.9	.39
Renal failure	4.9	1.1	.02
Sepsis	8.7	3.9	.06
Coagulopathy	1.9	1.1	.51
Stroke	1.0	0	.10
Surgical infection	13.6	12.1	.70
Reoperation	4.9	5.0	.85
Readmission within 30 d	5.8	5.0	.64
Mortality, No. (%)	7 (6.8)	1 (0.4)	.001
Length of hospital stay, d	12.0	10.2	.04

COMMENT

Life expectancy for the geriatric population is increasing, and this is affecting health care and treatment of surgical diseases. As the frequency of major abdominal operations being performed in older patients rises, there is an associated rise in procedures involving fecal ostomies. Clearly, surgeons will increasingly be confronted with older patients undergoing operations that involve the consideration of creating a fecal ostomy. With more older patients being subject to ostomies, it is important to evaluate the risk of these procedures in patients of advanced age. Several studies examined the effect of ostomies on surgical outcome. Irvin et al[24] studied the operative risks in patients with colorectal cancer and reported that the placement of a diverting colostomy yielded a 13% mortality and that most colostomies were performed in the emergency setting. Agarwal et al[16] reported that the 30-day mortality was 24% in older patients who underwent colostomy creation. In an audit of colorectal surgical procedures performed in octogenarians, Isbister[19] reported that this age group requiring emergency procedures had a higher incidence of stomas and that subsequent mortality rates were also higher. Although these studies contribute to our understanding of the effect of an ostomy procedure in older populations, the data are limited.

The aim of this study was to specifically evaluate the short-term surgical outcome of ostomy procedures in older patients, as well as to determine if subsequent stoma reversal procedures are well tolerated. Traditional surgical outcome measures were evaluated, and these focused on operative morbidity and mortality and on the effectiveness of therapy from the perspective of the health care system. Measures of effectiveness studied included use of ICU resources, blood transfusions and indication for hyperalimentation, and length of hospital stay.

This study included 383 patients undergoing procedures involving new fecal ostomies. One hundred three patients were 70 or older. In this older group of patients, the most frequent diagnosis was malignancy in 74.8%, with diverticulitis (11.7%) and IBD (2.9%) less commonly encountered. In younger patients, IBD was common (28.9%), and this reflected the referral pattern to our facility. Previous studies[5,18-21] of older patients undergoing colorectal surgery documented a similar higher incidence of malignancy. Because colorectal cancer is predominantly a disease of older people, we can anticipate an associated rise in the incidence of this disease as the population continues to live longer. How aggressively we treat colorectal cancer in patients of advanced age has been the focus of multiple investigations, and 2 recent systematic reviews concluded that curative surgery should not be withheld from older patients based on age alone.[8,23]

Of the 103 older patients in this study, 45 (43.7%) were subject to emergency procedures. This rate is higher than in previous reports that examined all types of colorectal surgery in older populations and were not limited to procedures involving ostomies. Chiappa et al[17] reviewed their experience with surgical outcomes in 346 consecutive older patients with colorectal cancer and found that 29% of patients 65 and older underwent emergency procedures. The review by Isbister[19] of colorectal surgery in older persons documented an emergency procedure rate of 37% in octogenarians. The reason for the higher rate of emergency operations in older patients undergoing ostomies is multifactorial. Ostomies are often performed in the emergency setting in patients of all ages. In addition, it has been suggested that older patients present with serious illnesses as emergencies because they are more likely to ignore symptoms or delay seeking medical attention.[19] They also often have nonspecific and complex symptoms, such as anemia or anorexia, and may not be referred early in their course for surgical evaluation.[25] The result of more emergency procedures being performed is a rise in postoperative complications and mortality rates.[6,8,22] Boyd et al[6] reported a mortality of 17.6% in older patients who had emergency colorectal procedures vs 3.4% in patients who had elective procedures.

Older patients in our study had significantly higher incidences of comorbid illnesses and were classified with higher ASA scores. Significant cardiovascular disease was

observed in 35.9% of patients 70 and older, with diabetes mellitus, chronic obstructive pulmonary disease, hypertension, and cognitive impairment being more prevalent than among younger patients. American Society of Anesthesiologists scores in older persons were higher, with scores of III or IV present in 54.4%. An increased frequency of comorbid conditions with advanced age has been identified in previous reports and has been shown to adversely affect surgical outcome measures.[2,6,8,23] Older patients have a natural physiologic decline that may impair the ability to compensate appropriately for the added stress of complicated surgery. However, the presence of significant comorbid conditions is the most important determinant of surgical outcome.[26] As with other major operations, emphasis should be placed on evaluating preoperative cardiovascular, pulmonary, renal, and nutritional states and avoiding emergency surgery when possible.

The specific type of ostomy created in most older patients was different from that in younger patients, with more end colostomies (49.5% vs 41.1%) and fewer end ileostomies (6.8% vs 15.0%). This is related to a higher incidence of cancer in older patients, leading to proportionately more end colostomies secondary to abdominoperineal resections and Hartmann procedures. Abdominoperineal resections were performed in 36.8% of the older patients with colorectal cancer, suggesting a high incidence of advanced or low-lying rectal cancer. Younger patients were more frequently operated on for complications of IBD, thereby resulting in a higher occurrence of total colectomies and end ileostomies. As a result of proportionately more abdominoperineal resections and end colostomies, the older group of patients experienced a higher percentage of permanent stomas (59.2% vs 41.1%, $P=.002$).

The stoma reversal rate observed in eligible older patients was lower than in younger patients. In analyzing this variable, the type of ostomy must be considered. Loop ileostomy or loop colostomy, often created with the expectation that it will be temporary, can be reversed with an operation of lesser magnitude and often through a peristomal incision. By contrast, end colostomies and end ileostomies require laparotomies or laparoscopic-assisted procedures to reverse. These are more complex operations with greater risk of morbidity. One possible explanation for the lower reversal rate in older patients would be a higher percentage of patients with end stomas. However, this was not observed in the present study. Of those older patients eligible for stoma reversal, 66.7% (younger patients, 59.4%) had diverting loop ostomies and 33.3% (younger patients, 40.6%) had end ostomies. The lower reversal rate can be explained, at least in part, by a traditional reluctance to perform elective operations in patients of advanced age.

This study confirmed that ostomy reversal can be safely performed in older patients. Only 2 (6.1%) of 33 older patients undergoing stoma reversal experienced complications, with no patient deaths. In an analysis of colon surgery in older populations, Greenburg et al[5] described 13 patients older than 70 who underwent successful colostomy takedown, with no mortality. In planning reversal procedures, the quality of life and social impairments associated with an ostomy must be considered. Older patients have difficulties in properly managing a stoma bag, and the bag affects their psychological well-being.[27] Independent maintenance of the stoma may not be attainable. If acceptable candidates, patients of any age should be offered ostomy takedown.

Table 5. Ostomy Reversal*

Variable	Age ≥70 y (n = 103)	Age <70 y (n = 280)	*P* Value
Eligible for ostomy reversal	**42** (40.8)	**165** (58.9)	
Diverting loop ileostomy	26 (61.9)	96 (58.2)	
End colostomy with distal pouch	13 (31.0)	50 (30.3)	
Diverting loop colostomy	2 (4.8)	2 (1.2)	
End ileostomy with distal pouch	1 (2.4)	17 (10.3)	
Ostomy reversal performed	33 (78.6)	157 (95.2)	.002
Delay until ostomy reversal, mean†	186 d	160 d	
Complications during stoma takedown, %	6.1	4.5	.66

*Data are given as number (percentage) unless otherwise indicated. Some percentages do not sum to 100 because of rounding.
†Delay from index operation to stoma takedown procedure.

An analysis of surgical outcome measures confirmed that older patients experienced more ICU admissions; longer hospital stays; more postoperative cardiovascular, respiratory, and renal complications; and a higher mortality rate. This has been observed in previous systematic reviews of colorectal surgery[8,23] and was not unexpected. However, significant differences were not observed in hyperalimentation use, blood transfusions, postoperative pneumonia, surgical infections, and sepsis. In addition, 30-day reoperation and readmission rates were similar. This study supports the premise that, although older patients experience a higher rate of postoperative complications and mortality, their surgical outcome following ostomy procedures remains within acceptable standards. Because surgical outcome is more dependent on preoperative conditions and comorbid diseases than age alone, we should not alter our treatment plan based solely on age. The same consideration afforded younger patients should be given to older patients when deciding whether an ostomy is indicated and on the type of stoma.

This study focused on short-term surgical outcome. The longer-term outcome must also be considered. When evaluating the use of surgical intervention in older populations, careful consideration should be made of the likelihood of achieving its potential benefits of maintaining and prolonging life, relieving pain and suffering, and improving function and quality of life. Maintaining independence cannot be undervalued. Life expectancy is a relevant issue, but it is not the only yardstick for estimating net treatment benefits in patients of advanced age.[28]

In conclusion, older patients undergo proportionately more permanent fecal ostomies than younger patients and experience a higher rate of postoperative morbidity and mortality. Their surgical outcome, however, remains within acceptable standards. Age alone should not dictate operative intervention. Finally, older pa-

tients fare well with stoma reversal and should be offered the procedure if eligible.

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