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ORIGINAL ARTICLE

A novel patient-centered protocol to reduce hospital readmissions for dehydration after ileostomy

Federica Gonella[1] · Antonio Valenti[2] · Paolo Massucco[1] · Nadia Russolillo[1] · Michela Mineccia[1] · Andrea Pierluigi Fontana[1] · Daniela Cucco[2] · Alessandro Ferrero[1]

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Abstract

Early hospital readmission for dehydration represents a relevant problem among patients with diverting or terminal ileostomy. The aim of the study was to evaluate the efficacy of a new multidisciplinary individualized multistep protocol in terms of reduction of hospital readmission for dehydration. Since January 2016, our institution adopted a new protocol for patients with ileostomy. Protocol key points were: preoperative personalized education in stoma management; early recognition of dehydration symptoms; multidisciplinary counseling; patient autonomy in stoma management through post-operative recall schedule. The study compared a series of consecutive patients treated before (2014–2015) and after (2016–2017) the protocol application. The primary endpoint was hospital readmission rate after protocol use. The secondary endpoint was the identification of possible risk factors for readmission. The entire cohort was composed of 296 patients, 129 in the protocol group and 167 in the control one. The two groups were homogeneous for baseline characteristics. Hospital readmission rate within 30 days post-discharge for dehydration dropped from 9 to 3.9% after protocol application. Specifically, the number of avoided potential readmissions was 29/129 (22.4%). The number needed to treat (NNT) was 20. Univariate analysis identified three relevant variables: patient comorbidities, diuretics use as risk factors and protocol application as the protective one. The multivariate analysis confirmed patient comorbidity as the risk factor. Dehydration related to ileostomy is a potentially avoidable problem, by employing preventive strategies, especially in high-risk patients. Our new protocol could be a simple and cost-saving method, effective in preventing hospital readmissions.

Keywords Ileostomy · Dehydration · Hospital readmission · Protocol

Introduction

Ileostomy creation is a common procedure in colorectal surgery, both in oncological setting and benign diseases like inflammatory bowel disease (IBD) and diverticulitis. In literature, high rates (> 50%) of stoma-related complications have been reported. They include: stoma stenosis, retraction and necrosis; ileus; skin alterations; dehydration [1, 2]. Dehydration represents the main cause of hospital readmission in patients with ileostomy. The physiopathology of dehydration due to ileostomy is well known. The lack of absorption function of the colon causes loss of liquids and electrolytes, affecting first the kidney function and then the cardiac and neurological activity. Ileostomy leaks are generally well compensated in the long run by majority of the patients, through diet variation and increasing liquid introduction [3–5]. Nevertheless, rates between 10–20% but also up to 40% of early hospital readmissions are due to dehydration [6]. In the last 10 years, many centers focused their attention on dehydration in patients with ileostomy, because of the economic impact of hospital readmissions. Some studies focused on different risk factors for readmissions, such as age, comorbidities, absence of caregiver, neoadjuvant chemotherapy, post-operative complications, previous bowel surgery, short post-operative stay [6–9]; other papers reported preventive strategies applied in ileostomy patients to avoid dehydration [10–12]. In line with these previous studies, a new protocol with intrinsic advantages was created and adopted in our institution for all patients with

✉ Federica Gonella
gonella.federica@gmail.com

[1] General and Oncological Surgery, Umberto I Mauriziano Hospital, Corso Turati 62, 10128 Turin, Italy

[2] Enterostomal Center, Umberto I Mauriziano Hospital, Corso Turati 62, 10128 Turin, Italy

ileostomy creation. The aim of the study was to evaluate the efficacy of this protocol in terms of readmission rate reduction. Furthermore, we focused on individuation of high-risk patients for dehydration.

Materials and methods

Since January 2016, a new multidisciplinary individualized multistep protocol has been adopted in our center for patients with ileostomy. Exclusion criteria were: patients with short bowel syndrome, patients with physical or neurological deficit, patients that cannot continue follow up in our center. The protocol key points were: preoperative personalized education in stoma management; early recognition of dehydration signs and symptoms; multidisciplinary counseling; post-operative recall schedule.

The study compared a single series of patients with ileostomy creation operated before (January 2014–December 2015) and after (January 2016–December 2017) protocol application. Patients' hospital readmissions within 30 days from discharge were registered. As regards hospital readmissions, both emergency department and ward accesses were considered. Hospital readmissions after 30 days from discharge were not evaluated, as they could be influenced by other factors, such as collateral effects of adjuvant chemotherapy.

The primary endpoint was hospital readmission rate for dehydration after protocol use. The secondary endpoint was the identification of possible risk factors for readmission.

The manuscript conformed to the EQUATOR guidelines for observational studies. All participants were informed about the study protocol through a detailed oral interview and written informed material, and all accepted the inclusion in the study protocol.

The current study was conducted in accordance to the principles of Helsinki Declaration (last version 2008).

Protocol details

The educational pathway starts in the preoperative setting, with at least two meetings between the stoma nurse and patient together with the caregiver. They are educated about stoma function and management. During hospitalization, patients receive multidisciplinary counseling by surgeons, dietitians and stoma nurses. Patients and their caregivers are educated in dealing with stoma problems and the benefits of a balanced diet. They are also provided with printed informative material. Patients learn to quantify ileostomy loss and to recognize dehydration signs and symptoms. After discharge, patients are followed up with periodic outpatient visits with surgeon, dietitian, stoma nurse, and through the recall schedule. Post-operative recall schedule is a simple flow chart working as explained below and in Fig. 1.

Within 3–5 days from discharge, patients are expected to recall enterostomal nurse. They are asked about their body weight, stoma loss in 24 h, liquid consumption during the day, urine characteristics and problems in stoma management. Talking about ileostomy loss, 1 L/day is considered as the reference cutoff to start intervention, since it is a slightly higher value than the normal one; furthermore it corresponds to the same cutoff value we consider during hospitalization to modify therapy. As regards body weight, patients are invited to always use the same instrument and carry out measurements in similar conditions (time of the day, clothing worn) to obtain uniform parameters. According to the given answers, patients can be classified into three different categories. Group 1: weight reduction less than 1 kg, stoma output less than 1 L/24h, positive liquid balance, no signs of dehydration. In this case, an educational reinforcement on diet and liquid assumption is sufficient. Group 2: weight reduction less than 1 kg, stoma output more than 1 L/24 h, positive liquid balance, no signs of dehydration. After discussion with the surgeon, anti-diarrheal drugs were advised along with increasing liquid introduction; a new recall is planned within 24–48 h and an outpatient visit within 5 days. Group 3: weight reduction more than 1kg, stoma output more than 1 L/24 h, negative liquid balance, signs of dehydration. According to their risk factors (age, comorbidities), patients are invited to the emergency department or outpatient access for clinical examination, laboratory tests and i.v. fluid implementation. The recall schedule works until patients do not find their own autonomy in stoma management.

Statistical analyses

All statistical analyses were performed with IBM SPSS Italy (v20.0). Categorical variables were compared using the Chi-square test, Fisher's exact test or Pearson's test, as appropriate. Continuous variables were compared using unpaired *t* test or Mann–Whitney *U* test, as appropriate. A binomial logistic regression analysis was performed to assess predictive factors of hospital readmission for dehydration.

Results

The entire cohort is composed of 296 patients, 129 in the protocol group and 167 in the control one. The groups are homogeneous for baseline characteristics: age over 70 years old, M/F ratio, comorbidities, scholar level, and patient therapy (Table 1). The diagnosis was IBD in 28.7% and 38.8% of patients in the control and protocol group, respectively, colorectal neoplasm in 45% of patients in both groups, and other

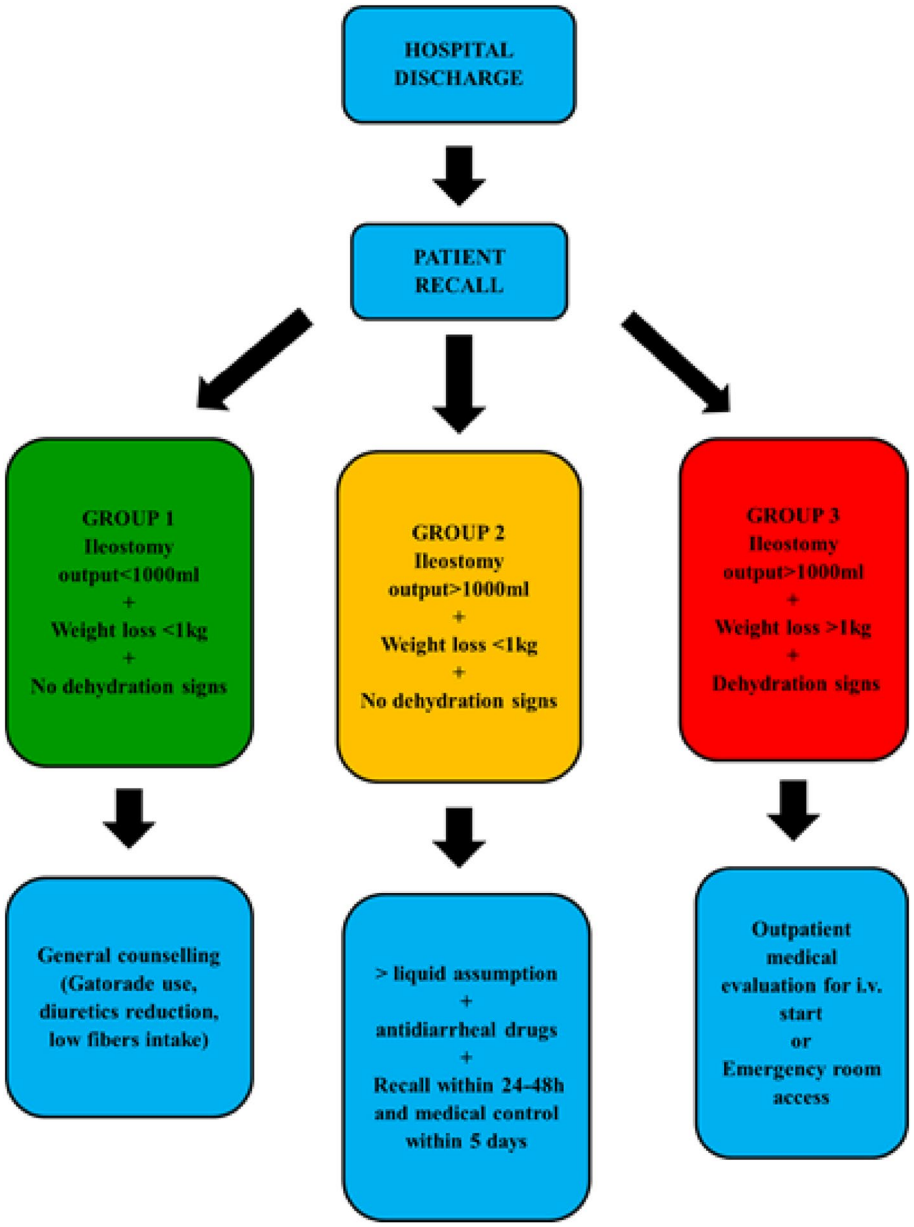

Fig. 1 Post-operative recall schedule

reasons (diverticulitis, bowel ischemia) in 26.3% of control group patients and 16.3% of protocol group ones. Urgency operations (defined as laparotomy underwent within 4 h from diagnosis of perforation, bleeding, ischemia, occlusion) are more frequent in the control group rather than in the protocol one (45% vs 27%); on the contrary, IBD diagnosis is more frequent in the protocol group than in the control one (38.8% vs 27.7%). Both differences do not affect the readmission rate.

As regards all causes of readmissions, in the first period, 21.6% (36/167) patients were readmitted within 30 days from discharge, while in the following 2-year period, the same figure was 13.2% (17/129). Hospital readmission rate for dehydration within 30 days post-discharge dropped from 9 (15/167) to 3.9% (5/129) after protocol application. Other causes of hospital readmission registered in this series are: abdominal collections, non-abdominal infections (urinary tract, wound) and no operation-related causes. Dehydration/other causes of readmission ratio is 42% in the control group and 30% in the protocol one. Table 2 shows the relationship between corrective actions applied with recall schedule and readmission rate. In detail: no patients in group 1 and 2 (89 and 22, respectively) were readmitted for dehydration, while 3/10 (30%) patients in group 3 were readmitted to hospital within 30 days from discharge. Hence, the percentage of avoided potential readmissions is 22.4% (29/129, 22 of group 2 and 7 of group 3). 8/129 (6%) patients did not join the recall schedule, of these, 2/8 (25%) were readmitted to

Table 1 Patients' baseline characteristics: urgent setting operations are more frequent in the control group rather than in the protocol one; at the opposite, IBD diagnosis is more frequent in the protocol group than in the control one

Variables	Control group (*n*° 167)	Protocol group (*n*° 129)	*p* value
Age > 70 years	54 (32.3%)	46 (35.7%)	.549
Sex M vs F	95 (56.9%)	85 (65.9%)	.116
Presence of comorbidities	75 (44.9%)	62 (48.1%)	.590
Diagnosis			
Colorectal neoplasm	75 (44.9%)	58 (45%)	.99
IBD	48 (28.7%)	50 (38.8%)	.069
Diverticulitis	12 (7.2%)	6 (4.7%)	.36
Urgent setting	76 (45.5%)	35 (27.1%)	.001
Steroid assumption	23 (13.8%)	11 (8.5%)	.160
Diuretics assumption	11 (6.6%)	7 (5.4%)	.679
Low scholar level	96 (57.5%)	78 (60.5%)	.835

Table 2 Relationship between recall schedule–interventions and readmission rates: Thanks to recall schedule, 22.5% (29/129) patients avoided potential hospital readmission

Protocol group	Patients' number	Readmission rate
1	89/129 (69%)	0/89 (0%)
2	22/129 (17%)	0/22 (0%)
3	10/129 (8%)	3/10 (30%)
No recall	8/129 (6%)	2/8 (25%)

hospital for dehydration. The number needed to treat (NNT) is 20. Univariate analysis evidenced three relevant variables: patients' comorbidities, diuretics use and protocol application ($p = .008$, $p = .08$ and $p = .08$, respectively). The first two are risk factors, while the last one is a protective factor for hospital readmission (Table 3). During the multivariate analysis (Table 4), patient comorbidity was confirmed as the risk factor ($p = .03$).

Discussion

Hospital readmission for dehydration after ileostomy creation is a relevant issue in colorectal units, with a strong impact on patients' quality of life and hospital costs. Rates up to 40% are reported in literature, despite different preventive strategies applied. The first possible reason could be the non-standardized stoma education given to patients. For example, it is reported that dietary recommendations at discharge are extremely variable and sometimes in disagreement with each other in different centers [13]. The second

Table 3 Univariate analysis: Considering *p* value < .10, Pearson Chi-square test revealed three relevant variables: comorbidities, diuretics assumption and protocol application

Variables	No readmission (*n*° 276)	Readmission (*n*° 20)	Value	*p* value
Age > 70 years	91 (33.0%)	9 (45.0%)	1.206	.272
Sex M vs F	167 (60.5%)	13 (65.0%)	0.158	.691
Comorbidities	122 (44.2%)	15 (75.0%)	7.114	.008
IBD diagnosis	94 (34.1%)	4 (20.0%)	1.664	.197
Open vs laparoscopy	168 (60.9%)	16 (80.0%)	2.943	.230
Urgent setting	104 (37.7%)	7 (35.0%)	0.057	.811
Steroid assumption	32 (11.6%)	2 (10.0%)	0.047	.829
Diuretics assumption	15 (5.4%)	3 (15.0%)	2.987	.084
Protocol application	124 (44.9%)	5 (25.0%)	3.012	.083

Table 4 Multivariate analysis: patient comorbidities is the significative variable

Variables	Number of patients	OR (CI 95%)	*p* value
Comorbidities			
Y	137	3.625 (1.241–10.590)	.032
N	159		
Diuretic assumption			
Y	18	1.808 (0.452–7.231)	.402
N	278		
Protocol application			
Y	129	0.078 (0.135–1.111)	.078
N	167		

Y yes, *N* no

probable explanation could be the increasing number of high-risk patients undergoing surgery. Age, comorbidities, caregiver, and scholar level should also be considered in the stoma education process.

The present study describes the new protocol created and applied in our institution since January 2016 on all patients with ileostomy creation, except those with small bowel syndrome, physical/neurological impairment, and those unable to continue follow up in our center. We registered all readmissions within 30 days from discharge before and after protocol application. In accordance with literature data, also in our cohort, dehydration represents the main cause of early hospital readmission. Rates up to 30–40% justify the interest in finding new corrective strategies, to improve post-operative patients' recovery and enable them to continue the treatment pathway (adjuvant chemotherapy, immunomodulating

drugs). Our goal was to create an effective protocol, patient-centered, that could be feasible and cost saving.

The protocol presented is defined as multistep since the educational pathway starts in preoperative setting, continues during hospital stay and follows up after discharge. It involves different specialists: surgeons, dietitians and stoma nurses that play a key role in the relationship with patients and caregivers. The educational training is individualized, based on patient's age, scholar level and social environment. The most important and innovative aspect of this protocol is its intrinsic character of patient's own awareness, since he/she is progressively educated to become completely autonomous.

Other previous studies have argued about the importance of stoma education process in reducing hospital readmission. In 2012, Messaris described a population of 600 patients with ileostomy and underlined that the education pathway together with nurse home controls could be fundamental on hospital readmission rate reduction [6]. In the same year, Nagle's group first introduced the role of a multidisciplinary educational process, starting in the preoperative setting and structured on post-discharge home visits [10]. Hardiman and his group reported, in 2016, a 14% hospital readmission percentage (30% lower than before); the strength of the educational process was the adoption of a stoma checklist pre-discharge [11]. In 2017, Shaffer et al. described a reduction in readmission percentage for dehydration up to 8.7%, thanks to nurse home visiting program [12]. Different from all other protocols described, in our study, patients do not depend on nurse home visits to start or modify their therapy. They are discharged with all information and competence to manage their stoma with relative problems. Patients become rapidly autonomous, although they are regularly followed up. This aspect represents a strong advantage in terms of quality of life, especially for young patients and a simple way to reduce health costs.

A fundamental instrument of the protocol is the recall schedule. This is a simple method used to recognize dehydration risk patients early, treat them by an incremental step intervention scheme and avoid hospital readmission. As shown in Table 2, the major effect of recall schedule application regards patients at moderate and high risk of dehydration (group 2 and 3). In our series, in fact, more than 20% of patients avoided potential hospital readmission for dehydration thanks to telephonic advice (therapy and diet adjustments, outpatient or emergency department access). On the contrary, one quarter of those patients that did not follow the recall schedule required hospital readmission for dehydration.

Iqbal's group also proposed a recall schedule after discharge with different corrective actions according to patients' problems. In his protocol, he adopted a standard scheme of interventions and the telephonic recall is made by nurses or physicians. He reported a reduction in hospital readmission from 65 to 16%, but the study is limited by the small sample size (less than 40 patients) [14]. On the contrary, the recall schedule described in our study is based on patient recall and the reference phone number is that of the same stoma nurse that followed up the patient before and after the operation. This element increases patients' compliance and enables nurses to better advise the patients, since they already know his/her medical and social environment. The efficacy of our method is reflected by an almost complete patient adherence.

In the present work, we compared two ileostomy patient groups, operated before and after protocol introduction. A strong difference is observed in hospital readmission rate for dehydration between the two periods. In fact, the rate of ileostomy patients admitted to hospital within 30 days post-discharge dropped from 9 to 3.9% after protocol application. This important result is in line with that showed by Nagle et al.. They reported a readmission rate reduction from 15 to 0% after a revised educational process, although the study is limited by the small sample size (40 patients) [10].

The second aim of this study is identification of dehydration risk factors, to describe categories of high-risk patients since the preoperative setting. This aspect is particularly relevant because the association of multiple risk factors such as patients' features, anatomical and oncological conditions, could actually shift the surgical choice preoperatively. For instance, surgeons could find it more beneficial creating a colostomy instead of ileostomy. Univariate analysis underlines as risk variables for dehydration, comorbidities and diuretics use. On the contrary, the protocol application represents a relevant protective factor. Multivariate analysis confirms patients' comorbidities as the risk factor. Other previous papers described the risk factor analysis for dehydration in ileostomy patients. In 2013, Paquette and Hayden groups focused on the following risk variables: age > 50 years old, total colectomy with ileopouch-anal anastomosis for the first group, neoadjuvant chemotherapy and anti-diarrheal use for the second one [7, 8]. Unlike Paquette, our multivariate analysis did not show any influence on hospital readmission due to IBD diagnosis and old age. As regards the first point, it is important to underline the relevance of a correct preoperative diagnosis in IBD patients to establish proper timing and surgical treatment. In fact, in recent literature reports, cases of endometriosis associated or mimicking IBD are described, in particular Crohn's disease [15, 16]. Differential diagnosis between these two entities can be challenging even in reference institutions like ours, since intestinal deep infiltrating endometriosis (the most aggressive form) and IBD share some characteristics: young patients' age, intestinal involvement producing stenosis, and the multifocal pattern of distribution. In our dataset, all diagnoses of Crohn's enteritis and ulcerative colitis were confirmed histologically.

Talking about the second point, in our cohort, there is a relevant number of patients over 70 years old with neoplasm diagnosis. As evidenced by recent papers, the management of elderly neoplastic patients is often less effective in comparison with younger ones, since they are considered to be very frail and with a shorter life expectancy. Nevertheless, the analysis presented by Shuurman et al. reveals that, when treated, elderly patients gain advantages in terms of mortality. Both reports focus the attention on avoiding undertreatment, by a personalized patient management [17, 18]. According to the mentioned articles, in our center, the surgical operation is tailored to the patient performance status and comorbidities, and ileostomy creation is considered especially in high-risk patients.

On risk factors' identification, Fish et al. published in 2017 a detailed retrospective analysis. They described as risk factors for hospital readmission, age > 65 years old, comorbidities, absence of caregiver, post-operative complications, previous bowel surgery and short post-operative stay [9].

The first limit of the present study is the small sample size that affects variables' statistical significance. We consider, in fact, protocol application to be a relevant factor in readmission rate, although the *p* value is .08. In the future, it will be necessary to expand the cohort to reinforce this result. The retrospective design of the study minimally affects the completeness of clinical data, first because patients' information were collected in all their pathway and secondary because patients unable to complete follow-up in our center were excluded from the study.

The study has many strengths. The major one is represented by the protocol itself. The combination of the recall schedule with hospital education results in a simple instrument, feasible for all patients, that enhances patient autonomy in everyday life. Other strengths are the homogeneity of the cohort as regards baseline characteristics, diagnosis and type of operations; the completeness of patient information and events, since clinical data are collected meticulously and readmission events are registered both in emergency and ward department; the minimization of selection bias, related to the fact that patient population is collected in a continuous period, operated and followed up by the same specialist group.

Conclusions

The present study focuses on the relevant problem of dehydration risk in ileostomy patients, with a strong impact on patients' quality of life and health care system costs. We described a novel protocol applied in our reality that, different from others previously reported, aims to ensure patient autonomy in stoma management. We demonstrated its efficacy in terms of hospital readmission reduction. Hence, this protocol could represent a simple and cost-saving method to reduce early hospital readmission for dehydration and improve patient's quality of life. As regards possible risk factors identification, patient comorbidities represent an important risk factor for readmission. Further studies are necessary to validate these data, to identify high-risk category patients already in the preoperative setting.

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interest.

Ethical approval All procedures performed were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained by all patients who participated to the study.

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