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ORIGINAL ARTICLE

Extended Monitoring for Transition to Oral Corticosteroids in Acute Severe Ulcerative Colitis May Be Unnecessarily Prolonging Length of Stay

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Abstract

Background There is no guideline regarding whether patients treated with intravenous corticosteroids for acute severe ulcerative colitis (ASUC) should be monitored in the hospital after transitioning to oral steroids. Our study aimed to: (1) compare rates of oral steroid transition failure and 30-day readmission between ASUC hospitalizations with extended inpatient monitoring compared to accelerated inpatient monitoring, and (2) identify predictors of oral steroid transition failure.

Methods A retrospective cohort study of ulcerative colitis (UC) related admissions at UCSF from 2014 to 2022 was conducted comparing rates of steroid transition failures in extended inpatient monitoring (≥ 24 h on oral steroids prior to discharge) to accelerated inpatient monitoring (< 24 h on oral steroids). Steroid transition failure was defined as worsening colitis activity with the need to return to IV steroids or undergo colectomy. Data analysis incorporated demographics, disease features, and treatment history.

Results Transition failures from intravenous to oral corticosteroids occurred in 8% of all UC-related admissions. There was a significant difference in transition failure observed between the extended and accelerated monitoring groups, 13 vs 3% ($p = 0.03$), respectively, with 83.3% of total transition failures occurring within the extended monitoring group. The 30-day readmission rate was 6% in each group ($p = 0.93$). No significant predictors of transition failures were identified.

Conclusion Transition failures from IV to oral steroids are uncommon in ASUC hospitalizations. Transition failures were more likely to occur with extended monitoring, suggesting potential predictors and/or patient selection bias within this group. Further studies are needed to investigate the parameters driving clinician decision-making regarding oral steroid transitioning.

Keywords IBD · Ulcerative colitis · Length of stay · Hospitalization · Corticosteroids

Introduction

Ulcerative colitis (UC), one of the major types of inflammatory bowel disease (IBD), is a chronic inflammatory condition of the colonic mucosa that causes recurrent symptoms and significant morbidity. Approximately 25% of patients with UC are hospitalized at some point for their disease, with the average length of stay ranging from 4.6 to 12.5 days [1, 2]. Hospitalization costs contribute to the high economic burden for both patients and healthcare systems [3].

Acute severe ulcerative colitis (ASUC) is a potentially life-threatening emergency that almost always requires inpatient management. Although up to 30% of patients hospitalized for ASUC will ultimately require colectomy, most can avoid surgery with aggressive medical management with short-duration, pulsed high-dose intravenous corticosteroids [4–6]. This is typically followed by clinical assessment

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for steroid responsiveness using validated prognostic indices such as the Travis Criteria and Ho Index [7]. If deemed responsive, patients are then transitioned to oral steroids, with plans for outpatient steroid tapering.

Despite the availability of clinical guidelines for inpatient management of ASUC, there is a paucity of recommendations pertaining to steroid-responsive patients transitioning from intravenous to oral steroid agents, and whether these patients should remain in the hospital to be monitored for any worsening of symptoms that would warrant re-escalation of steroid or other rescue therapy [3, 6, 8]. Some institutions have asserted that patients need not be kept in the hospital specifically for this reason [2]. Others have indicated in their severe ulcerative colitis protocol that patients should demonstrate clinical stability on oral prednisone for 12–24 h prior to discharge [7]. In the absence of data regarding the efficacy of extended inpatient monitoring in capturing oral steroid transition failures, practice patterns may vary widely.

To address this knowledge gap regarding the utility of inpatient steroid transition monitoring, we conducted a retrospective, single-center study on ASUC-related admissions at the University of California, San Francisco. Our main objectives were: (1) compare rates of oral steroid transition failure and readmission between ASUC hospitalizations with extended inpatient monitoring ($\geq$ 24 h on oral steroids prior to discharge) vs accelerated monitoring ($<$ 24 h on oral steroids prior to discharge); (2) identify predictors of oral steroid transition failure.

Materials and Methods

Participants

For this retrospective cohort study, a chart review was performed for all ulcerative colitis-related admissions at the University of California, San Francisco, from August 17, 2014, to March 28, 2022. All adult patients with the primary diagnosis of ulcerative colitis receiving intravenous corticosteroids were included. Patients were excluded if they never transitioned to oral steroids either during the hospitalization or on discharge, or if they had prior colectomy. Patients who underwent colectomy during the hospitalization were only included if the surgery was pursued after a failed trial of oral steroids following a course of pulsed high-dose intravenous steroids.

Procedures

Subjects were identified retrospectively using hospitalization ICD-9 and ICD-10 codes associated with ulcerative colitis, and by prospective review of the gastroenterology consult service daily census. All data were collected from the electronic health record. Data collected included age, gender, length of stay, previous oral steroid use within 30 days prior to admission, previous hospitalization for any reason within 90 days prior to admission, and previous exposure to advanced ulcerative colitis therapy prior to admission. Details of the hospitalization and care rendered were also collected, including Mayo endoscopic subscore, maximum initial heart rate, maximum initial serum C-reactive protein (CRP) level, initial serum albumin level, types of medications administered (opiates, biologics, and other rescue therapy), hospital day on which the first trial of oral corticosteroids following a course of intravenous steroids was initiated, and readmission for ulcerative colitis within 30 days of discharge. Heart rate and serum CRP level were recorded as binary variables (heart rate $>$ 90 bpm; CRP $>$ 45 mg/L) in accordance with Truelove and Witt's classification of severe ulcerative colitis and Travis Index's criteria for probable intravenous steroid failure on hospital day 3 for ASUC, respectively [2, 7].

We defined oral steroid transition failure ("failure to transition") as documented clinical decompensation following the switch from intravenous to oral steroid therapy that warranted re-escalation of therapy in the form of restarting pulsed high-dose intravenous corticosteroids or proceeding with colectomy within 90 days of index admission. "Extended" inpatient monitoring was defined as remaining admitted while clinically stable for at least 24 h following the switch from intravenous to oral steroid therapy. "Accelerated" monitoring was defined as less than 24 h of oral steroid exposure prior to discharge. The accelerated monitoring group also included those discharged on oral steroids without receiving any inpatient oral doses.

Statistical Analyses

Continuous parameters were reported as median and interquartile range. Discrete parameters were reported as number and percent. Comparisons were made with Mann–Whitney *U* tests for continuous data and Pearson chi-square tests for categorical data. A p-value ≤ 0.05 was considered statistically significant for all analyses. Univariable analyses were performed to identify factors associated with oral steroid transition failure. Multivariable logistic regression analysis was then performed on variables that were significant in the univariable analysis and those that the authors felt had a high likelihood of being confounders. Data were analyzed using STATA v16.1 (College Station, Texas).

Study procedures were compliant with the Health Insurance Portability and Accountability Act (HIPPA). The Institutional Review Board (IRB) of the University of California, San Francisco (UCSF) approved the study.

Results

Patient Demographics and Clinical Characteristics

During the study period, 148 patients met inclusion criteria. Eighty patients (54.1%) were observed for ≥ 24 h post-transition to oral steroids ("extended monitoring" group), while 68 patients (45.9%) were observed for < 24 h post-transition to oral steroids ("accelerated monitoring" group) (Table 1). Extended monitoring group had a median length of stay of 8 days (IQR 6–10, $p = 0.01$), while accelerated monitoring group had a median length of stay of 5 days (IQR 3.5–10, $p = 0.01$). There were no significant differences in demographics or clinical characteristics between the two groups. Median age was 30.5 years and 65% identified as female. Regarding prehospitalization-exposure variables for the extended monitoring group compared to the accelerated monitoring group, 34 vs 22% of patients had been hospitalized (for any cause) within 90 days prior to the index ASUC admission, 65 vs 62% had received oral corticosteroids within 30 days prior to index admission, 33 vs 46% were biologic-therapy naïve, 67 vs 54% had a history of biologics exposure.

Regarding disease activity and severity variables for the extended monitoring group, 76% had maximum heart rates of > 90 bpm within their first 24 h of admission, 51% had a maximum CRP level > 45 mg/L. There was some missing data regarding Mayo endoscopic score and serum albumin levels. Mayo scores were recorded for only 106 subjects out of 148, and serum albumin was available for only 133 out of 148 subjects. Of the subjects in the extended monitoring group for which we had data, 61% had a Mayo endoscopic score of severe, 73% had a serum albumin < 3.5 g/dL on admission. In terms of treatment-exposure variables for the extended monitoring group, 76% received a maximum dose of 40 mg IV methylprednisolone vs 24% who received 60 mg IV methylprednisolone. 44% of all subjects received opioids during the course of their hospitalization and 67% also received rescue medical therapy during the hospitalization (Table 1).

Transition failure from intravenous to oral corticosteroids occurred in 8% of all UC-related admissions in this study. There was a difference in transition failure observed between the extended and accelerated monitoring group, 13 vs 3% ($p = 0.03$), respectively, with the transition failures in the extended monitoring group comprising 82% of total transition failures in this study. 30-day readmission rates after discharge for both groups were the same, 6% ($p = 0.93$) (Fig. 1).

Predictors of Transition Failure to Oral Corticosteroids

The initial univariable logistic regression analyses showed that patients who failed oral steroid transition failures were more likely to have received oral steroids within 30 days prior to admission (OR 1.16, 95% CI 0.31, 3.81, $p = 0.89$), have a recent hospitalization within 90 days prior to admission (OR 1.29, 95% 0.37, 4.53, $p = 0.69$), have prior biologics exposure (OR 1.28, 95% 0.37, 4.45, $p = 0.70$), severe mayo colitis score (OR 1.52, 95% 0.29, 7.96, $p = 0.62$), however none of these findings were statistically significant. Administration of opiates during the hospitalization (OR 7.36, 95% CI 1.55–34.91, $p = 0.01$) had a significant association with oral steroid transition failure (Table 2). Moreover, patients in the accelerated monitoring group were trialed on oral steroids sooner in their hospitalization than those in the extended monitoring group, day 5 compared to day 6.5 ($p = 0.01$).

Disease-related and treatment-related variables of ASUC were assessed as predictors of transition failure to oral corticosteroids using multivariable logistic regression, adjusting for oral steroid use within 30 days prior to admission, Mayo endoscopic subscore, initial serum CRP level, hypoalbuminemia on admission, administration of opiates, and inpatient monitoring for at least 24 h after de-escalation of steroid therapy. With multivariable modeling, no significant associations between these factors and oral corticosteroid transition failure were found (Table 2).

Discussion

We conducted a retrospective cohort study on adult patients hospitalized for acute severe ulcerative colitis to assess the impact of extended monitoring on corticosteroid 30-day readmission rates and transition failures. Several studies have also looked at factors associated with readmission in ulcerative colitis patients [9–11], our study found that extended monitoring on corticosteroids was not associated with a decreased likelihood in 30-day readmission. In addition, our study found a low rate (8%) of oral steroid transition failure overall, suggesting that most patients will do well after transitioning to oral steroids. Patients who were deemed clinically appropriate to forego extended inpatient monitoring had particularly low rates of oral corticosteroid failure (3%). Extended inpatient monitoring for ≥ 24 h on oral steroids was not associated with a decreased likelihood of transition failure or 30-day readmission. In fact, we found that extended inpatient monitoring was paradoxically associated with an increased likelihood of oral steroid transition failure.

There are many potential explanations for this. For one, a prior study showed that patients with clinical markers of more severe inflammatory bowel disease (i.e., tachycardia, elevated CRP, or severe Mayo scores at the time of admission) were associated with longer hospitalizations [12]. Therefore patients who were clinically selected for extended

Table 1 Demographic and Clinical characteristics for the total patient cohort and by monitoring group post-transition from IV to PO steroids

	Total $n=148$	Accelerated Monitoring (< 24 h post-transition) $n=68$	Extended Monitoring (≥ 24 h post-transition) $n=80$	*P* value
	n (%)	n (%)	n (%)	
Median age (IQR)	32 (43–24)	34.5 (25–44.5)	30.5 (24–41.5)	0.32
Median length of stay (IQR)	7 (4–10)	5 (3.5–10)	8 (6–10)	0.01
Gender				
Female	96 (65)	44 (65)	52 (65)	0.97
Male	52 (35)	24 (35)	28 (35)	
Received oral steroid therapy within 30 days prior to admission				
Yes	94 (64)	42 (62)	52 (65)	0.68
No	54 (36)	26 (38)	28 (35)	
Recent hospitalization within 90 days prior to admission				
Yes	42 (28)	15 (22)	27 (34)	0.12
No	106 (72)	53 (78)	53 (66)	
Biologics exposure prior to admission				
0 agents ("naïve")	57 (39)	31 (46)	26 (33)	0.10
1 + agents	91 (61)	37 (54)	54 (67)	
Mayo endoscopic colitis score[a]				
Not Severe	35 (33)	20 (57)	15 (43)	0.08
Severe	71 (67)	28 (39)	43 (61)	
Clinical characteristics within 24 h of admission				
Maximum HR > 90 bpm	109 (74)	48 (71)	61 (76)	0.44
Maximum serum CRP > 45 mg/L	75 (51)	34 (50)	41 (51)	0.88
Hypoalbuminemia	96 (72)	44 (71)	52 (73)	0.77
Maximum 24 h IV methylprednisolone dose				
40 mg	117 (79)	56 (82)	61 (76)	0.36
60 mg	31 (21)	12 (18)	19 (24)	
Received opioids during hospitalization				
Yes	65 (44)	31 (46)	34 (43)	0.71
No	83 (56)	37 (54)	46 (57)	
Received biologics or other rescue therapy during hospitalization				
Yes	99 (67)	41 (60)	58 (73)	0.12
No	49 (33)	27 (40)	22 (27)	
Hospital day of transition from IV to PO steroids				
Median (IQR)	6 (4–7)	5 (4–7)	6.5 (5–8)	0.01
Failure to transition from IV to PO steroids				
Yes	12 (8)	2 (3)	10 (13)	0.03*
No	136 (92)	66 (97)	70 (87)	
30-day Readmission for ASUC after discharge				
Yes	9 (6)	4 (6)	5 (6)	0.93
No	139 (94)	64 (94)	75 (94)	

ASUC acute severe ulcerative colitis, *CRP* C-reactive protein, *HR* heart rate, *IV* intravenous, *PO* oral, *PTA* prior to admission

[a]Comparing only among those with Mayo scores documented; $n=106$

[b]Comparing only among those with serum albumin documented; $n=133$

*Denotes statistical significance at the $p<0.05$ level

% are column percentage unless otherwise indicated

inpatient monitoring by their provider team were more likely to experience oral steroid transition failure and trialed on oral corticosteroids 1.5 days later than the accelerated inpatient monitoring group. Moreover, there was a trend toward more need for rescue therapy in the extended monitoring group, 73 vs 60% ($p=0.12$) and less bio-naïve patients, 33 vs 46%

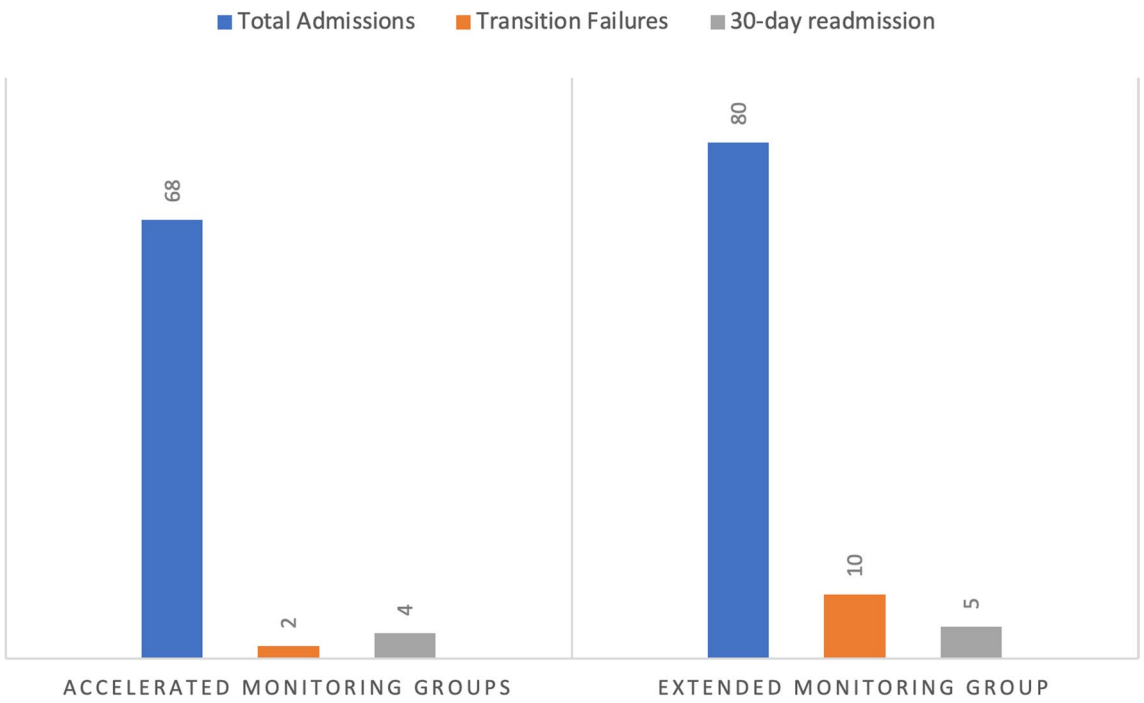

Fig. 1 Transition Failures between Accelerated and Extended Monitoring Groups

Table 2 Univariate and Multivariate analyses of failure to transition from IV to PO steroids

	Unadjusted OR 95% CI	*p* value	Adjusted OR[C] 95% CI	*p* value
Age (years)	0.95 (0.88, 1.00)	0.07	0.93 (0.83, 1.03)	0.17
Sex (Female)	1.09 (0.31, 3.81)	0.89	0.80 (0.15,4.29(	0.80
PO steroids within 30 days PTA	1.16 (0.33, 4.06)	0.81	0.70 (0.13, 3.69)	0.68
Recent hospitalization within 90 days PTA	1.29 (0.37, 4.53)	0.69	1.21 (0.18, 8.10)	0.84
Biologics prior to admission vs biologic-naive	1.28 (0.37, 4.45)	0.70	0.70 (0.12, 3.87)	0.68
Severe Colitis (Mayo score)[a]	1.52 (0.29, 7.96)	0.62	0.89 (0.12, 6.15)	0.90
Maximum serum CRP > 45 mg/L	2.06 (0.59, 7.16)	0.26	3.97 (0.62, 25.25)	0.14
Hypoalbuminemia[b]	1.81 (0.37, 8.80)	0.46	2.41 (0.29, 20.28)	0.42
Received opioids during hospitalization	7.36 (1.55, 34.91)	**0.01**	4.68 (0.76, 28.96)	0.10

ASUC acute severe ulcerative colitis; *CRP* C-reactive protein; *HR* heart rate; *IV* intravenous; *PO* oral; *PTA* prior to admission. *CI* confidence intervals; *OR* odds ratio

[a]Comparing only among those with Mayo scores documented; $n = 106$

[b]Comparing only among those with serum albumin documented; $n = 133$

Bolded values denotes statistical significance at the $p < 0.05$ level

% are column percentage unless otherwise indicated

($p = 0.10$) which may reflect that biologic-experienced patients are more likely to start inpatient rescue therapy due to more refractory or difficult to control disease, however, this was a statistically insignificant finding.

Due to the small overall number of patients who experienced oral steroid transition failure, we lacked statistical power to identify the predictors driving these phenomena. The association between extended monitoring and transition failure may be the result of astute clinician decision-making, wherein patients deemed at higher risk for clinical decompensation were preferentially observed for a longer period of time after transitioning to oral steroids. Indeed, the observation that patients selected for extended monitoring had a tendency to spend more time on IV steroids supports this hypothesis.

The association between extended monitoring and transition failure may also be confounded by the fact that prolonged length of stay increases a hospitalized patient's risk of adverse events such as hospital-acquired infections, deconditioning, poor nutrition, adverse drug effects, and venous thromboembolism [13, 14]. An alternative explanation is that individual clinician practice styles, rather than objective patient disease severity, contribute to the timing of steroid transition and subsequent duration of observation. Clinicians with a more "conservative" practice style may keep patients on IV steroids for longer and also watch patients on oral steroids for longer prior to discharge. It has also been demonstrated that patients admitted to tertiary medical centers are more likely to undergo more extensive work-up and treatment when compared to community sites, thus contributing to prolonged hospitalizations [15]. Our study did not survey clinicians regarding their practice style, and this is a topic for future investigation.

Healthcare expenditures continue to rise at unsustainable rates; over the past two decades, the cost of caring for IBD has nearly doubled, in part from the increased use of expensive but effective biologic agents in the maintenance of disease [16, 17]. IBD patients incur annual costs that are three-fold higher than non-IBD patients ($22,987 compared to $6956) [7]. This financial burden impacts both the health system and the individual, as IBD patients experience paying twice the out-of-pocket costs of a non-IBD patient, in addition to likely lost wages and elevated insurance premiums [7, 18].

In light of this, our study aimed to contribute to high-value care of an increasingly expensive disease and improve hospital-wide quality outcomes by reducing unnecessarily prolonged lengths of stay. Understandably, some patients admitted for ASUC would benefit from extended inpatient monitoring post-transition to oral steroids. However, given our study's finding of overall low rates of transition failures, we argue that such a practice should be selective rather than routine, as it appears that most patients do not benefit from extended monitoring. Improving how we select patients for prolonged inpatient monitoring on oral steroids would improve cost-effective care [19] by reducing wasteful overtreatment in patients who would otherwise fare well with a shorter monitoring duration.

This study had several limitations. Although we discovered that subjects in the extended monitoring group were more likely to experience transition failure, our study was not able to meaningfully identify specific clinical predictors of steroid failure, likely reflecting insufficient power rather than a true lack of such predictors. Therefore, a multi-center study would be able to better identify clinical predictors of steroid transition failures. Another limitation of this study is its retrospective approach. In a prospective cohort study, patients would ideally be assigned a priori or randomized to either extended or accelerated monitoring groups. As a result, transition failures in the extended monitoring group may potentially be exaggerated as patients with more severe illness during their hospitalization are more likely to have an extended hospitalization as a result. Moreover, patients in this cohort study were cared for by a heterogeneous group of both hospital medicine and gastroenterology providers, whose own intrinsic practices around steroid transitions and discharge may have varied. Future studies should assess clinician practice styles as a potential novel target for quality improvement interventions.

In summary, patients with ASUC who were transitioned to oral steroids had low rates of inpatient failures and 30-day readmissions. Accelerated (< 24 h) inpatient monitoring after transitioning to oral steroids appears safe in carefully selected patients, and can potentially be cost-saving without worsening clinical outcomes. This precedent can be further explored and iteratively investigated through quality improvement projects aimed at reducing prolonged hospitalization and overtreatment. Further studies are needed to identify clinical predictors of steroid failure that would warrant extended monitoring.

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Author's contribution S.E. and J.C wrote the main manuscript text, and S.E. prepared all the figures and Tables 1 and 2. All authors reviewed the manuscript.

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Data availability Data not publicly available but can be securely furnished by request.

Declarations

Competing interest The authors have no conflict of interest to declare.

Ethical approval This study was approved by the Institutional Review Board at the University of California, San Francisco.

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