Improving the Care of Bowel Obstruction in People with Advanced Cancer

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Abstract

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Background:

Malignant small bowel obstruction (mSBO) is common in patients with advanced abdominal-pelvic cancers. Management includes prioritizing quality of life and avoiding surgical intervention when possible. Use of dexamethasone to restore bowel function was demonstrated in three small, randomized trials and is recommended in the National Comprehensive Cancer Network (NCCN) guidelines for mSBO. Yet, these guidelines were based upon very limited data related to effectiveness and guideline adherence is unknown in non-research settings. Furthermore, feasibility of a protocol guiding dexamethasone use for mSBO, which represents an opportunity for quality improvement (QI), has not yet been demonstrated.

Methods:

Project 1: Multi-center retrospective cohort study

We undertook a retrospective review of unique admissions for mSBO at 6 academic medical centers (Boston Medical Center, Columbia University, Rush University, University of Iowa, University of Michigan, University of Washington) from 1/1/2019-12/31/21. Dexamethasone use and non-elective operative interventions were abstracted from the medical record and summarized with descriptive and simple comparative statistics. Multiple logistic regression analysis was used to estimate the association between dexamethasone use and likelihood of subsequent non-elective operative intervention adjusted for site, age, sex, history of abdominal surgery, nasogastric tube decompression (NGT), and Gastrografin small-bowel follow-through (SBFT).

Project 2: QI initiative implementation

We designed, implemented, and evaluated a protocol guiding the use of dexamethasone for mSBO. The protocol was adapted from NCCN guidelines for dexamethasone use in mSBO and incorporated into an existing protocol for small bowel obstruction management, with revision by a multi-disciplinary team including clinicians from General Surgery and Medical Oncology services. It was implemented by the Acute Care Surgery service at the University of Washington Medical Center from 3/1/2022 to 3/1/2023. Protocol adherence was evaluated using a pre-post design comparing rates of dexamethasone use and non-elective operative intervention before and after protocol implementation. Outcomes were summarized with descriptive and simple comparative statistics.

Results:

Project 1: Multi-center retrospective cohort study

There were 571 total admissions where patients were eligible for dexamethasone during the study period (68% female, mean-age 63y, 85% history of abdominal surgery). Dexamethasone

was given in 26% (150/571) of these admissions (69% female, mean-age 63y, 88% history of abdominal surgery). Dexamethasone use by site ranged from 13% (25/190 admissions) to 52% (36/69 admissions). Adjusting for site, age, sex, history of abdominal surgery, NGT, and Gastrografin SBFT use, dexamethasone use was associated with a 40% decrease in the odds of subsequent non-elective operative intervention (OR: 0.6, 95%CI 0.3-1.1). The rate of non-elective operative intervention in patients given dexamethasone during the study period was 13% (20/150 admissions) and there were 4 dexamethasone safety-related events.

Project 2: QI initiative implementation

Following protocol implementation, dexamethasone use increased from 13% (25/190 admissions) pre-implementation to 52% (34/66 admissions) post-implementation.

Conclusions: Dexamethasone was used in about 1 in 4 eligible mSBO admissions with high variability of use between tertiary academic centers. This multi-center retrospective cohort study suggested an association between dexamethasone use and lower rates of non-elective surgery. A quality improvement initiative at a single institution demonstrated that implementing a protocol guiding the use of dexamethasone for mSBO resulted in increased use.

University of Washington

Thesis

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Background:

Malignant small bowel obstruction (mSBO) is a common and serious complication in advanced gastrointestinal or gynecologic cancer. While the exact incidence is unknown, mSBO has been estimated to affect 3-15% of all patients with cancer, with retrospective and autopsy studies suggesting prevalence rates of 5% to 51% of patients with ovarian malignancies and 10% to 28% of patients with gastrointestinal malignancies.[1-3] The management of mSBO is distinct from benign small bowel obstruction in part because of patients' decreased mobility and functional status, frequent lack of further chemotherapeutic options, and high mortality and morbidity associated with palliative surgery.[4]

The primary goal of mSBO management focuses on quality of life, including effective symptom control and avoiding surgery when possible.[5] Management of mSBO on an individual level is often multi-disciplinary with a combination of medical, surgical, or endoscopic options considered. Operative palliative intervention carries estimates of mortality of 9% to 40% and complication rates of 9% to 90% with overall survival from 3 to 6 months.[6] Furthermore, symptomatic improvement, gain of gastrointestinal function, or quality of life following surgical intervention for mSBO are rarely assessed or reported in the literature.[4] Therefore, there is a significant interest in non-operative measures to manage mSBO, specifically corticosteroid use.[7]

In a Cochrane review, which was last updated in 2016, with meta-analysis including data from 3 small randomized trials, patients with mSBO who receive dexamethasone had an odds ratio of 0.51 (95%CI 0.21-1.23) for unresolved bowel obstruction compared to placebo. The authors concluded that there was a trend for evidence that dexamethasone given intravenously at a dose ranging from six to 16 mg may bring about the resolution of bowel obstruction. Additionally, the incidence of corticosteroid related side effects was extremely low.[4,8,9]

Although the National Cancer Consortium Network (NCCN) recommended dexamethasone for mSBO in its 2009 palliative care guidelines, there is no contemporary national data on dexamethasone use in mSBO management, nor have outcomes for dexamethasone use in mSBO in clinical settings been reported.[10]

To address these questions, we undertook a multi-institutional retrospective cohort study assessing dexamethasone use for patients with mSBO and its association with non-elective

surgical intervention. Recognizing the opportunity for quality improvement following the retrospective cohort study, we then designed, implemented, and evaluated a management protocol guiding the use of dexamethasone for patients presenting with mSBO at the our institution. We report results and discuss implications of both the cohort study and protocol implementation effort in this thesis.

Methods:

Project 1: Multi-center Retrospective Cohort Study

Th cohort included unique admissions for mSBO at six academic centers (Boston Medical Center, Columbia University, Rush University, University of Iowa, University of Michigan, University of Washington), from 1/1/2019 to 12/31/21. Cohort identification and data abstraction were uniform across sites.

Data collection

Patient electronic medical records were reviewed. Diagnoses of mSBO were noted if a patient had radiographic or clinical evidence of small bowel obstruction secondary to new or known malignant disease. Patients were considered eligible for dexamethasone if they were admitted for mSBO, underwent initial non-operative management, and had no contraindication for dexamethasone such as active infection, shock, hyperglycemia, or previous intolerance to dexamethasone. Dexamethasone use was noted if at least one dose of IV Dexamethasone was given during non-operative management while inpatient. Non-elective operative intervention was noted if the patient underwent surgery at any point following initial non-operative management, exclusive of prophylactic or planned gastrostomy. In addition, demographics, comorbidities, cancer type, admission length-of-stay, nasogastric tube use, Gastrografin SBFT use, endoscopic or interventional radiology (IR) interventions, and dexamethasone safety events were collected.

Statistical analysis

Primary outcomes included rates of dexamethasone use for mSBO and rates of non-elective operative intervention. Outcomes were summarized with descriptive statistics including measures of central tendency and variability, means (standard deviation), frequencies (%), and 95% confidence intervals were calculated using the Wilson score interval method. Adjustments

for site, age, sex, history of abdominal surgery, nasogastric tube (NGT) decompression, and Gastrografin small bowel follow-through (SBFT) use were made using multiple logistic regression analysis with reported odds ratios (OR) and 95% confidence intervals. Subgroup analysis was performed for those with a history of prior abdominal surgery, for those who underwent Gastrografin SBFT, NGT decompression, or combined operative or endoscopic gastrostomy or stenting procedures, and for those with the five most common cancer types, including foregut, hepaticopancreaticobiliary, gastrointestinal, gynecologic, and genitourinary origins using multiple logistic regression analysis with reported ORs and 95% confidence intervals. All statistical analysis was performed using RStudio Statistical Software (version 2022.07.2+576., R Core Team 2022).

Project 2: QI initiative implementation

Given that preliminary results from the multi-center retrospective suggested a trend towards an association between dexamethasone use and reduced rate of non-elective surgical intervention, the Acute Care Surgery (ACS) team at the University of Washington designed and implemented a protocol for inpatient non-operative management of mSBO which incorporates NCCN guideline-concordant use of dexamethasone. The protocol was adapted from an existing protocol used by the ACS service at University of Washington for non-operative management of SBOs of multiple etiologies, with the addition of indications, dosing, and timing for IV dexamethasone per NCCN recommendations.[10] The protocol draft was revised through consensus by a multi-disciplinary team of clinicians from the ACS and Medical Oncology services at University of Washington and was implemented on March 1, 2022 on the ACS service for mSBO consults and admissions. (**Figure 1**)

A pre-post study design for protocol evaluation was used, with 1/1/2019-12/31/21 considered the pre-period and 3/1/2022 to 3/1/2023 considered the post-period. Cohort criteria and data collection methods were identical to that of our multi-institutional retrospective cohort study. Adherence to the mSBO protocol was evaluated by comparing rates of dexamethasone use before and after protocol implementation.

Results:

Project 1: Multi-center Retrospective Cohort Study

Cohort Characteristics

There were 498 patients who had 644 unique admissions for mSBO from 2019 to 2021 across 6 academic centers. 73 admissions were excluded because they were ineligible for dexamethasone, including 49 who underwent immediate surgical intervention and 24 who either did not tolerate dexamethasone previously, were in sepsis at presentation, or transitioned to comfort care immediately at presentation. There were 571 admissions where dexamethasone use was indicated per NCCN guidelines (mean age 63 years old, female sex 68%, history of prior abdominal surgery 85%). (**Table 1**) The most common cancer type in patients represented in cohort admissions was those of gynecological origin (36%), followed by gastrointestinal (25%), foregut (9%), and HPB (9%). (**Table 1**)

Dexamethasone Use

Of eligible admissions, 150 (26%, 95%CI 23-30%) received dexamethasone treatment (mean age 62 years old, female sex 69%, history of abdominal surgery 87%), whereas 421 (74%, 95%CI 70-77%) did not receive dexamethasone (mean age 63 years old, female sex 68%, history of abdominal surgery 84%). Between sites, the rate of dexamethasone use for eligible admissions varied between 13% to 52%. (**Figure 2**) There were no sociodemographic differences between those who received and those who did not receive dexamethasone. Of the 150 admissions where dexamethasone was given across institutions, 112 also received nasogastric tube decompression (75%, 95%CI 67-81%), 18 received Gastrografin SBFT (12%, 95%CI 8-18%), with a mean length-of-stay of 6.6 days (95%CI 5.6-7.6). Four dexamethasone-related safety-events were

reported, including 2 for hyperglycemia, 1 for concern for new infection, and 1 for hallucinations. Of the 421 admissions where dexamethasone was not used, 270 also received nasogastric tube decompression (64%, 95%CI 59-69%), 95 received Gastrografin SBFT (23%, 95%CI 18-27%), with a mean length-of-stay of 10.2 days (95%CI 9.2-11.2).

Subsequent non-elective operative intervention

Among the 150 admissions where dexamethasone was given, there were 20 (13%, 95%CI 9-20%) non-elective operative interventions, 5 (3%, 95%CI 1-8%) operative gastrostomies, and 34 (23%, 95%CI 17-30%) endoscopic enteral access or stenting procedures. Among the 421 admissions where dexamethasone was not used, there were 72 (17%, 95%CI 14-21%) non-elective operative interventions, 6 (1%, 95%CI 0-3%) operative gastrostomies, and 73 (17%, 95%CI 14-21%) endoscopic enteral access or stenting procedures.

Adjusting for site, age, sex, history of abdominal surgery, NGT, and Gastrografin use, dexamethasone use was associated with a 40% decrease in the odds of subsequent non-elective operative intervention (OR: 0.6, 95%CI 0.3-1.1). (**Figure 3**)

Subgroup analysis did not indicate that the association between dexamethasone use and likelihood of non-elective operative intervention differed amongst those with history of prior abdominal surgery, those who received NGT decompression, Gastrografin SBFT, or gastrostomy placement, or for any of the 5 most common cancer types noted. (**Table 3**)

Project 2: QI initiative implementation

The protocol guiding the use of dexamethasone for patients consulted or admitted for mSBO was implemented by the ACS service at the University of Washington on March 1, 2022. In the 3-

year pre-implementation period, there were 190 admissions (mean age 62 years old, female sex 67%, history of abdominal surgery 84%) for mSBO that were eligible for dexamethasone use. Of these, 25 (13%, 95%CI 9-19%) admissions received dexamethasone with a rate of non-elective operative intervention of 12% (95%CI 4-30%).

In the approximately 1-year post-implementation period , there were 66 admissions for mSBO (mean age 61 years old, female sex 64%, history of abdominal surgery 82%) eligible for dexamethasone use. Of these, 34 (52%, 95%CI 40-63%) admissions received dexamethasone with a rate of non-elective operative intervention, exclusive planned or prophylactic gastrostomy, of 9% (3-23%). (**Table 4**) The rate of dexamethasone use for mSBO admissions with the ACS service as a primary or consulting team was 66% (95%CI 51-78%), compared to 28% (95%CI 14-48%) amongst patients seen and managed exclusively by other primary teams including medical oncology, urology, or gynecology services.

Discussion:

In this thesis work, we presented a multi-institutional retrospective cohort study and a single-institution QI initiative to implement a protocol guiding the use of dexamethasone in mSBO management. In the retrospective cohort study, dexamethasone was used in only 1 in 4 eligible admissions for mSBO with high variability of its use between institutions. There were no sociodemographic differences between those who received and those who did not receive dexamethasone. After adjusting for site, age, sex, history of prior abdominal surgery, and other adjuncts of non-operative management such as NGT and Gastrografin SBFT, our data suggests an association, although with a confidence interval that includes 1, between the use of dexamethasone and fewer non-elective operative interventions with an odds ratio 0.6 (95%CI:0.3-1.1).

One of the major challenges of this study revolves around the multiple clinical endpoints that are possible for patients with mSBO. In this study we selected non-elective operations as the primary outcome given its clinical relevance and association with high morbidity and mortality. Resolution of bowel obstruction has been used as an endpoint in other studies. However, this is difficult to determine retrospectively given that many patients undergo no procedure and are discharged from the hospital, but without full tolerance of a normal diet and have nutrition supplemented with enteral tube feeds or partial or full TPN or enter into hospice care and die shortly after discharge.

Another challenge is determining the therapeutic intent for gastrostomies, either operative or endoscopic, whether they be placed to avoid a larger operation, or prophylactically in a more

elective setting if there is high clinical suspicion for recurrence. The OR after adjusting for site, age, sex, history of abdominal surgery, NGT, Gastrografin, and combined surgical gastrostomy and endoscopic enteral access or stenting procedures was similar to our model without adjustment for gastrostomy or endoscopic procedures (0.6 [95% CI : 0.3-1.1]. However, gastrostomies and endoscopic procedures were not included as covariates in the final logistic regression model given that the timing and intent of many of these procedures, whether prophylactic or planned in cases of high clinical suspicion for future recurrence of mSBO, was difficult to determine in this dataset. There was variation between institutions for rates of gastrostomy placements, although with subgroup analysis and regression modeling it was not a driver of our effect size.

The use of corticosteroids in palliative therapy is not novel and has been prescribed as part of palliative management for patients with advanced malignancy since the 1950s for its central antiemetic, anti-inflammatory, antisecretory, and analgesic effects.[7] mSBO can be caused bowel-occlusive intramural infiltration, extrinsic compression of bowel, functional motility disorders, or side effects of radiotherapy due to stricture and negative impacts on peristalsis.[11] Common pathophysiology to each process is the accumulation of fluid and gases via a cascade of inflammatory mediator release.[7,12] It is thought that steroids target the inflammatory mediator cascade and may be a potential treatment for mSBO by decreasing gut wall edema, peritoneal inflammation, and inflammation in proximity to the obstruction while indirectly decreasing pain via relief of luminal obstruction.[7,13]

A 1999 meta-analysis and a 2000 Cochrane review found a near doubling of the rate of non-operative resolution of mSBO with the use of corticosteroids, concluding there was "evidence that dexamethasone… may bring about the resolution of bowel obstruction".[8,9] These reviews included three randomized, placebo, double blind controlled trials (a total of 89 patients) (Hardy 1997a; Hardy 1997b; Laval 1998) as well as seven retrospective and prospective reports evaluating dexamethasone 5-15mg/day.[9] Meta-analysis of the randomized trials found an odds ratio of 0.51 (with confidence interval spanning 1) for unresolved mSBO after administration of dexamethasone.[4] However, since the inclusion of dexamethasone within NCCN's palliative guidelines for the management of mSBO in 2009, the rate of it use in non-research settings has not been evaluated. This study aimed to evaluate its use and effectiveness across multiple tertiary centers. Using the effect size suggested by this data, a randomized control trial comparing dexamethasone with placebo would require over 2800 patients. Given concerns over feasibility and cost of a such an RCT, future evaluation of dexamethasone may be limited to retrospective data.

Our retrospective data highlighted a QI opportunity given that 75% of eligible patients did not receive dexamethasone for management of mSBO. In our QI initiative, we demonstrated feasibility of protocol design and implementation along with an increase in dexamethasone use following one year of protocol use from 13% to 52%, with distinct confidence intervals. These rates were more pronounced for patients of the ACS service where the protocol was implemented. Next steps of this QI initiative include eliciting input from institutional stakeholders, including clinicians from Medical Oncology, Gynecology, and Urology services, in order to drive towards wider institution-wide adoption of standardizing care of mSBO patients at the University of Washington.

Of note, 85% of patients included in this study have a history of prior abdominal-pelvic surgery. The specific etiology of SBO in the patient with a known or new diagnosis of abdominal malignancy may be presumed to be malignant. However, in patients with prior surgery, adhesive SBO (aSBO) may be difficult to differentiate from mSBO with radiographic evidence alone and the ultimate diagnosis sometimes may only be confirmed in the operating room. With some elements of shared pathophysiology of extrinsic compression of bowel, negative impacts to peristalsis, and accumulation of fluid and gases associated with a cascade of inflammatory mediator release, adhesive SBO may represent an opportunity for evaluation of further uses of corticosteroids as an adjunct to non-operative bowel obstruction management.

Limitations

One limitation of the retrospective cohort study is confounding by indication for dexamethasone use as well as the inability to otherwise adjust for disease severity in admissions that are initially non-operative. Although we attempted to address confounding by indication by adjusting for site, age, sex, history of abdominal surgery, use of NGT decompression, and use of Gastrografin SBFT, we could not account for all or unknown confounders. Finally, our sample size and subsequent analyses, including subgroup analyses, suggested an association but was underpowered to demonstrate statistical significance.

Limitations of the QI initiative include adoption of the mSBO protocol by a single service out of many services which care for patients with mSBO. We also lacked a control group with which to contemporaneously compare our post-protocol rate of dexamethasone use, although we were not aware of any other factors that might independently impact rates of use. Our study design also

lacked a mechanism in order to identify barriers to wider adherence to the mSBO protocol, such as qualitative semi-structured interviews of stakeholders or surgical teams, which is worthy of consideration for future work towards wider adoption of NCCN guideline-concordant care.

Conclusions

In summary, dexamethasone was used in 1 in 4 eligible admissions for the management of mSBO per NCCN guidelines, with high variability between tertiary academic centers. After adjusting for sociodemographic and clinical factors, our data suggests an association, though with a confidence interval that spans 1, between the use of dexamethasone and fewer non-elective operative interventions (OR 0.6 [95%CI:0.3-1.1]). Overall, dexamethasone may be an important adjunct to usual non-operative management of mSBO and represents a potential opportunity for quality improvement. Implementation of a QI initiative consisting of a mSBO protocol guiding dexamethasone use resulted in higher rates of use of dexamethasone.

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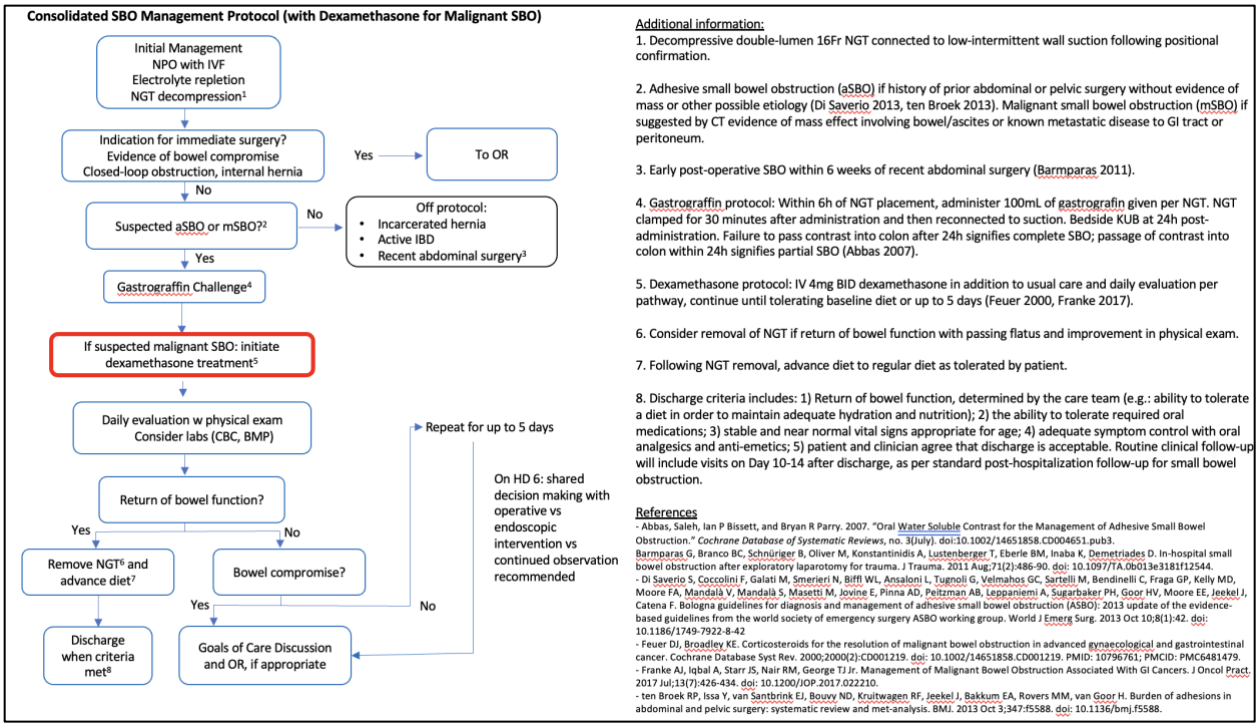
Figures and Tables

Figure 1. Dexamethasone for mSBO protocol, implemented by the ACS service at the University of Washington on March 1, 2022 for patients consulted on or admitted for mSBO.



Additional information:

1. Decompressive double-lumen 16Fr NGT connected to low-intermittent wall suction following positional confirmation.

2. Adhesive small bowel obstruction (aSBO) if history of prior abdominal or pelvic surgery without evidence of mass or other possible etiology (Di Saverio 2013, ten Broek 2013). Malignant small bowel obstruction (mSBO) if suggested by CT evidence of mass effect involving bowel/ascites or known metastatic disease to GI tract or peritoneum.

3. Early post-operative SBO within 6 weeks of recent abdominal surgery (Barmparas 2011).

4. Gastrograffin protocol: Within 6h of NGT placement, administer 100mL of gastrografin given per NGT. NGT clamped for 30 minutes after administration and then reconnected to suction. Bedside KUB at 24h post-administration. Failure to pass contrast into colon after 24h signifies complete SBO; passage of contrast into colon within 24h signifies partial SBO (Abbas 2007).

5. Dexamethasone protocol: IV 4mg BID dexamethasone in addition to usual care and daily evaluation per pathway, continue until tolerating baseline diet or up to 5 days (Feuer 2000, Franke 2017).

6. Consider removal of NGT if return of bowel function with passing flatus and improvement in physical exam.

7. Following NGT removal, advance diet to regular diet as tolerated by patient.

8. Discharge criteria includes: 1) Return of bowel function, determined by the care team (e.g.: ability to tolerate a diet in order to maintain adequate hydration and nutrition); 2) the ability to tolerate required oral medications; 3) stable and near normal vital signs appropriate for age; 4) adequate symptom control with oral analgesics and anti-emetics; 5) patient and clinician agree that discharge is acceptable. Routine clinical follow-up will include visits on Day 10-14 after discharge, as per standard post-hospitalization follow-up for small bowel obstruction.

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Figure 2. Variability among sites for dexamethasone use among eligible admissions.

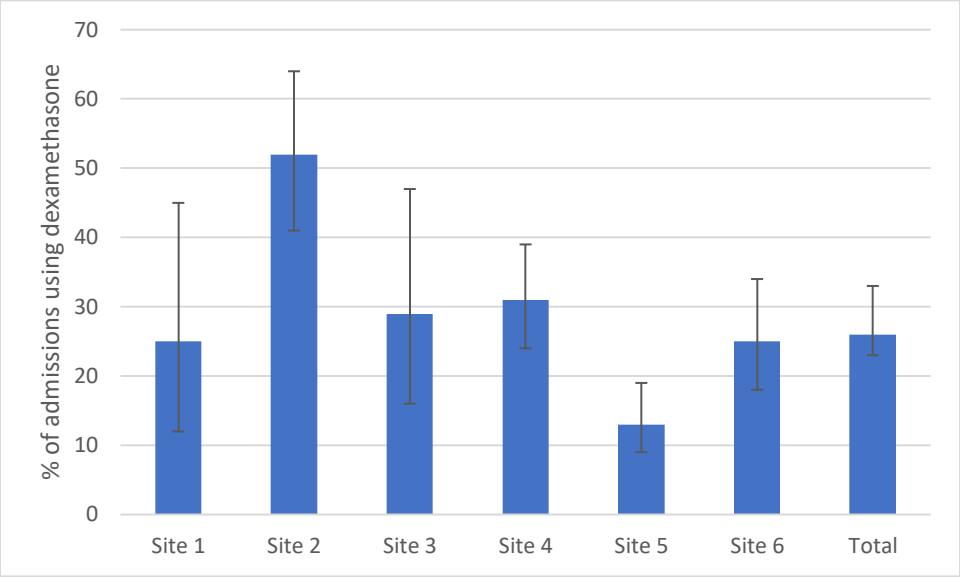

Table 1. Baseline characteristics of patients presenting with mSBO.

	Total admissions (n=571)	No dexamethasone (n=421)	Dexamethasone (n=150)
Age – years (mean±SD)	63 ± 13	63 ± 13	62 ± 12
Sex – no. (%)			
Female	391 (68%)	287 (68%)	104 (69%)
Male	180 (32%)	134 (32%)	46 (31%)
Cancer type – no. (%)			
Foregut	49 (9%)	22 (5%)	22 (15%)
HPB	54 (9%)	43 (10%)	11 (7%)
GI	145 (25%)	120 (29%)	25 (17%)
Gyn	204 (36%)	143 (34%)	61 (41%)
GU	40 (7%)	29 (6%)	11 (7%)
Blood	28 (5%)	22 (5%)	6 (4%)
Other	41 (7%)	29 (6%)	12 (8%)
Unknown	10 (2%)	8 (2%)	2 (1%)
History of prior abdominal surgery – no. (%)	484 (85%)	353 (84%)	131 (87%)

Table 2. Rates of urgent operative intervention following non-operative management of mSBO amongst those who received dexamethasone, stratified by site.

	Rates of urgent operative intervention			Unadjusted Odds Ratio for non-elective operative intervention with dexamethasone – OR (95%CI)	Adjusted Odds Ratio for non-elective operative intervention with dexamethasone – OR (95%CI)
	Total admissions – % (95%CI)	No dexamethasone – % (95%CI)	Dexamethasone – % (95%CI)		
Site 1	17% (7-36%)	22% (9-45%)	0% (0-50%)	N/A[1]	N/A[1]
Site 2	19% (11-30%)	27% (15-44%)	11% (4-25%)	0.3 (0.1-1.2)	0.3 (0.1-1.4)[2]
Site 3	35% (21-53%)	36% (20-57%)	33% (12-65%)	0.9 (0.2-4.5)	0.5 (0.1-3.2)[2]
Site 4	14% (9-20%)	14% (9-22%)	13% (6-25%)	0.9 (0.3-2.4)	0.7 (0.2-1.9)[2]
Site 5	13% (9-19%)	13% (9-19%)	12% (4-30%)	0.9 (0.2-3.2)	1.0 (0.2-3.2)[2]
Site 6	17% (11-26%)	18% (11-28%)	15% (6-34%)	0.8 (0.2-2.5)	1.0 (0.2-3.8)[2]
Total	16% (13-19%)	17% (14-21%)	13% (9-20%)	0.7 (0.4-1.3)	0.6 (0.3-1.1)[3]

[1]Model fails to converge given no operations were noted among those who underwent dexamethasone use
[2]Adjusted for age, sex, history of abdominal surgery, NGT, and Gastrografin SBFT use
[3]Adjusted for site, age, sex, history of abdominal surgery, NGT, and Gastrografin SBFT use

Figure 3. Adjusted odds ratio for non-elective operative intervention with dexamethasone use. a) Odds ratios (OR) for non-elective operative intervention with dexamethasone adjusted for age, sex, history of abdominal surgery, NGT, and Gastrografin SBFT use; and b) lower OR for non-elective operative intervention with dexamethasone use following covariate adjustments.

*Model fails to converge given no operations were noted among those who underwent dexamethasone use

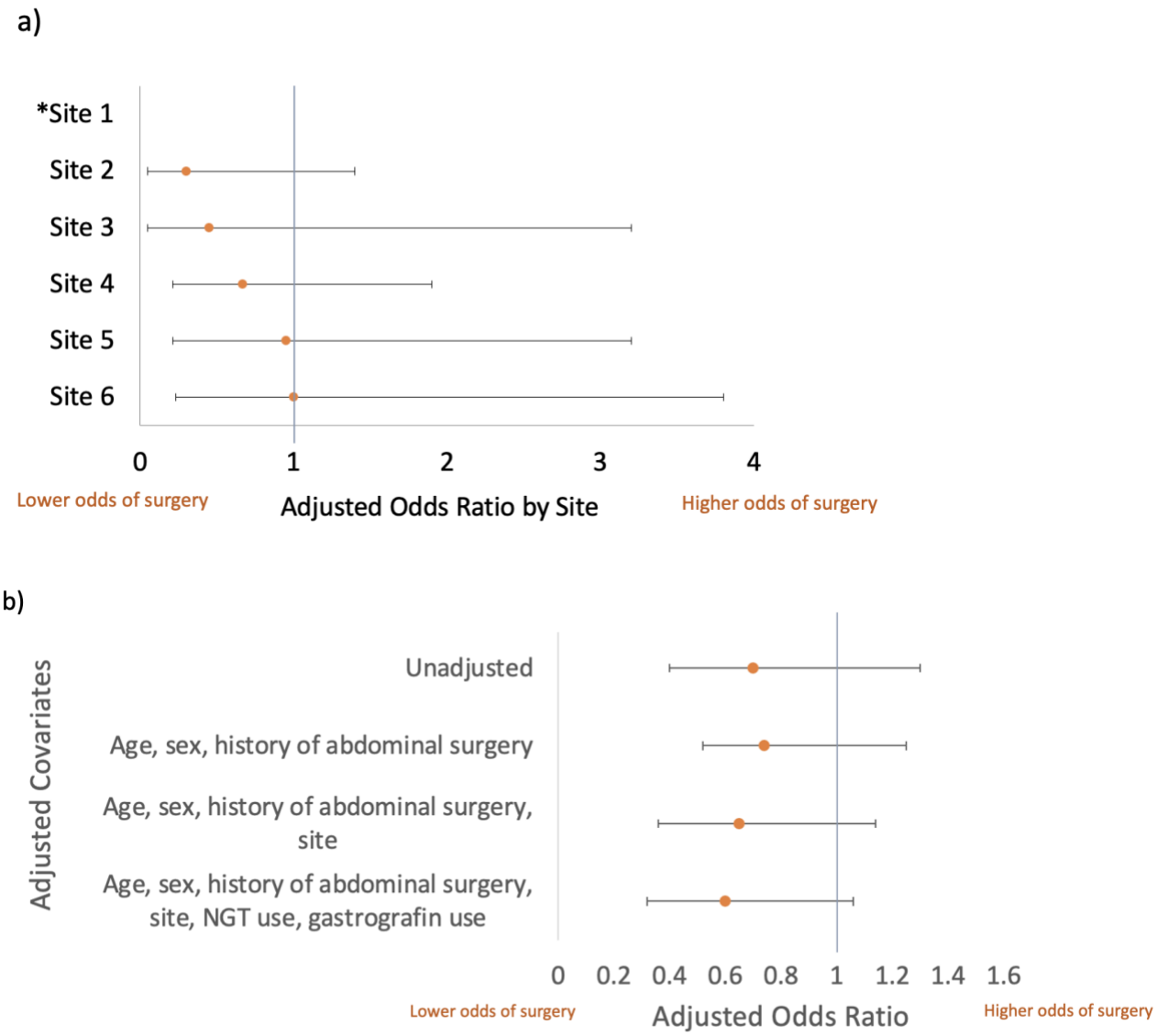

Table 3.

	Total eligible admissions (n=571)	No dexamethasone (n=421)	Dexamethasone (n=150)	Adjusted OR for non-elective operative intervention with dexamethasone
History of prior surgery				
History of abdominal surgery	486 (54%)	354 (84%)	132 (88%)	0.6 (0.3-1.2)[1]
No history of abdominal surgery	85 (15%)	67 (16%)	18 (12%)	0.3 (0.0-1.4)[1]
Management factors				
Gastrografin SBFT – no. (%)	113 (20%)	95 (23%)	18 (12%)	0.7 (0.1-2.7)[2]
NGT – no. (%)	382 (67%)	270 (64%)	112 (75%)	0.6 (0.3-1.1)[3]
Combined prophylactic gastrostomy or endoscopic PEG/stent – no. (%)	117 (20%)	79 (19%)	38 (25%)	1.1 (0.2-5.3)[4]
Cancer type				
Foregut – no. (%)	49 (9%)	22 (5%)	22 (15%)	2.6 (0.0-442)[4]
HPB – no. (%)	54 (9%)	43 (10%)	11 (7%)	3.8 (0.0-16)[4]
GI – no. (%)	145 (25%)	120 (29%)	25 (17%)	0.3 (0.0-1.4)[4]
Gyn – no. (%)	204 (36%)	143 (34%)	61 (41%)	1.0 (0.4-2.6)[4]
GU – no. (%)	40 (7%)	29 (6%)	11 (7%)	0.1 (0.0-3.1)[4]

[1]Adjusted for age, sex, site, NGT, and Gastrografin SBFT use
[2]Adjusted for age, sex, history of abdominal surgery, site, and NGT use
[3]Adjusted for age, sex, history of abdominal surgery, site, and Gastrografin SBFT use
[4]Adjusted for age, sex, history of abdominal surgery, site, NGT, and Gastrografin SBFT use

Table 4. Pre-post evaluation of Dexamethasone Protocol implementation at University of Washington

			Rates of urgent operative intervention		
	Total admissions	Use of dex – % (95% CI)	Total – % (95% CI)	No dex – % (95% CI)	Dex – % (95% CI)
Pre-protocol	190	13% (9-19%)	13% (9-19%)	13% (9-19%)	12% (4-30%)
Post-protocol	66	52% (40-63%)*	11% (5-20%)	13% (5-28%)	9% (3-23%)

*Use of dexamethasone in admissions with ACS primary or consulting was 66% (95% CI: 51-78%), compared to 28% (95% CI: 14-48%) amongst patients seen and managed exclusively by other primary teams including medical oncology, urology, or gynecology services.