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ORIGINAL CONTRIBUTIONS

Preventing Returns to the Emergency Department Following Bariatric Surgery

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Abstract
Background Unnecessary emergency department (ED) visits following bariatric surgery represent a significant source of inefficient resource utilization. This study aimed to identify potential strategies aimed at preventing unnecessary returns to the ED following bariatric surgery. The study was conducted in University Hospital, USA.
Methods The electronic medical records of all patients who underwent bariatric surgery at our institution between January 2011 and October 2015 were retrospectively reviewed. Information regarding procedure, gender, age, preoperative BMI, obesity-related comorbid conditions, postoperative length of stay (LOS), and reasons for ED visits within 90 days of surgery were obtained. Six practitioners (four attending surgeons, one resident physician, and one physician assistant) independently reviewed patient chief complaint and clinical findings at the time of ED returns. Reasons for ED return were scored as either preventable or non-preventable. "Preventable" denoted that an ED return could potentially be avoided by means of a system change in our bariatric practice.
Results Our institution performed 361 bariatric procedures during the study period. Of these, 65 patients had 91 ED visits, 23 of which resulted in readmissions, and two of which required operative interventions. The ≤90-day all-cause postoperative ED visit rate was 18% (n = 65). Of the 91 ED visits, 47% were deemed preventable (n = 43). The most common preventable reasons for ED returns were nausea, vomiting, dehydration (NVD) (27.9%), postoperative pain (25.6%), wound evaluations (20.9%), and compliance issues (14%).
Conclusions Postoperative ED visits following bariatric surgery are prevalent and costly. Many of these visits are potentially preventable. Implementing outpatient strategies to address these causes will likely attenuate inefficient resource utilization.

Keywords Bariatric surgery · Co-morbidity · Gastric bypass · Laparoscopy · Logistic regression · PPR · Preventable · Readmission · Risk factors · Sleeve resection · Emergency department utilization

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Introduction

In recent years, bariatric surgery has experienced rapid growth and is now the second most common type of abdominal surgery performed in USA. [1, 2] Owing to more than 40% of women and 35% of men now classified as obese, the rise in bariatric surgery is likely to persist [3]. While the health benefits of weight loss surgery are well documented, readmissions following bariatric surgery impose a significant economic burden to the US healthcare system and rightfully have become important metrics of quality and safety [4, 5]. For that reason, reporting of hospital readmissions is a mandatory component of the unified Metabolic Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) [6, 7].

Although related, unplanned emergency department (ED) visits following bariatric surgery were not tracked by the MBSAQIP prior to January 2016 and consequently are poorly characterized with respect to healthcare utilization [8]. Considering that inefficient ED usage is responsible for $38 billion in wasteful spending each year, the importance of such characterization cannot be understated [9]. By some estimates, approximately 56% of all ED visits are estimated to be potentially avoidable and more specifically, 75% of bariatric patients who present to the ED do not require inpatient admission [8–11].

We have reviewed our institutional experience with post bariatric surgery ED visits during the first 4 years of a newly established university-based bariatric surgical program. Our goal in this analysis was to identify potential strategies to prevent unnecessary returns to the ED.

Methods

Study Design

Following institutional review board approval, the electronic medical records of all patients who underwent bariatric surgery at a university hospital-based bariatric surgery program between January 2011 and October 2015 were retrospectively reviewed. Information regarding procedure, gender, age, preoperative BMI, obesity-related comorbid conditions, postoperative length of stay (LOS), and reasons for ED visits within 90 days of surgery were obtained. Preoperative psychological profile data was reviewed, and Charleson comorbidity indices (CCIs) were calculated for all individuals. Bariatric surgery was defined as open Roux-en-Y gastric bypass (RYGB), laparoscopic Roux-en-Y gastric bypass (LRYGB), laparoscopic adjustable gastric band (LAGB), and sleeve gastrectomy (SG). Additionally, revisional bariatric surgeries (RBSs) were included in our analysis. All ED visits occurring within 90 days postoperatively to our institution and its affiliated hospitals were captured using our electronic data warehouse.

Six practitioners (four attending surgeons, one resident physician, and one physician assistant) independently reviewed patient chief complaint and clinical findings at the time of ED returns. Reasons for ED return were scored as either *preventable* or *non-preventable*.

For the purposes of this study, *preventable* was used to denote that a particular ED return could potentially be avoided by means of a system change in our bariatric practice (e.g., intravenous fluids administered in clinic, wound evaluation on an outpatient basis, anticipatory phone calls, etc.). Postoperative ED visits were scored *non-preventable* using the following algorithm: either management of the presenting chief complaint was beyond the scope of outpatient resources (e.g., acute chest pain, hemodynamic instability) or the patient's chief complaint could potentially be managed as an outpatient, *but* symptoms were unrelated to surgery and therefore would not normally be triaged during a surgical nurse phone call or seen in the surgery clinic (e.g., otitis media, migraine). Following independent scoring, group deliberation yielded final consensus scores for each ED visit.

Results

Patient Demographics

Three hundred sixty-one bariatric procedures were performed at our institution between January 2011 and October 2015. Of these, 65 patients returned to the ED within 90 days of surgery. Descriptive characteristics of the study cohort are shown in Table 1. Of the 65 patients seen in the ED, 45 were women and 20 were men. The mean patient age was 45 years (range 20–82). The mean preoperative body mass index was 45.5 kg/m^2 (range 19.4–66). The most common bariatric surgical approach among the 65 patients was LRYGB (n = 48; 73.8%), SG (N11; 16.9%), RYGB (n = 1; 1.5%), and LAGB (n = 1; 1.5%). RBS comprised 6.1% (n = 4) of our study group.

Comorbidities

Of the 65 patients, 32.3% had type-two diabetes, 12.2% had a history of heart failure or arrhythmia, and 3% had chronic renal failure (Table 1). The average CCI of all patients returning to the ED was 1.4 (range 0–8), while the average CCI of patients requiring admission and/or reoperation were 2.4 and 2, respectively.

All-Cause Postoperative ED Visit Rate Occurring ≤90 days

Of the 361 patients who underwent bariatric surgery during the study period, 65 patients required 91 ED visits, 23 of which resulted in readmissions (23/361, 6.4%) and two of

Table 1 Patient demographics, comorbidities, and operative approach of 65 ED returns

Characteristics					
Surgical approach	*n* (%)	RYGB 1 (1.5)	LRYGB 48 (73.8)	SG 11 (16.9)	LAGB 1 (1.5)	RBS 4 (6.1)
Gender						
Male	20 (30.7)	[a]	14 (21.5)	4 (6.2)	1 (1.5)	1 (1.5)
Female	45 (69)	1 (1.5)	34 (52.3)	7 (10.8)	[a]	3 (4.5)
Age (years)						
18–29	7 (10.8)	[a]	6 (9.2)	1 (1.5)	[a]	[a]
30–39	18 (27.7)	[a]	14 (21.5)	4 (6.2)	[a]	[a]
40–49	20 (30.8)	1 (1.5)	12 (18.5)	4 (6.2)	1 (1.5)	2 (3.0)
50–59	12 (18.5)	[a]	11 (16.9)	1 (1.5)	[a]	[a]
60–69	6 (9.2)	[a]	3 (4.6)	3 (4.6)	[a]	[a]
70–79	1 (1.5)	[a]	[a]	[a]	[a]	1 (1.5)
80–89	1 (1.5)	[a]	[a]	[a]	[a]	1 (1.5)
BMI (kg/m^2)						
18.5–24.9	2 (3.0)	[a]	1 (1.5)	[a]	[a]	1 (1.5)
25.0–29.9	2 (3.0)	[a]	[a]	[a]	[a]	2 (3.0)
30.0–34.9	1 (1.5)	[a]	[a]	[a]	[a]	1 (1.5)
35.0–39.9	9 (13.8)	[a]	6 (9.2)	3 (4.6)	[a]	[a]
40.0–49.9	32 (49.2)	[a]	26	6 (9.2)	[a]	[a]
50.0–59.9	17 (26.2)	[a]	14	2 (3.0)	1 (1.5)	[a]
>60.0	2 (3.0)	1 (1.5)	1 (1.5)	[a]	[a]	[a]
Comorbidities						
DM	15 (23.1)	[a]	12 (18.5)	2 (3.0)	1 (1.5)	[a]
HD	2 (3.0)	[a]	[a]	2 (3.0)	[a]	[a]
RF	1 (1.5)	[a]	[a]	1 (1.5)	[a]	[a]
DM∩HD	5 (7.7)	1 (1.5)	3 (6.2)	[a]	[a]	1 (1.5)
DM∩HD∩RF	1 (1.5)	[a]	[a]	1 (1.5)	[a]	[a]
− (DM∪HD∪RF	41 (63.1)	[a]	33 (50.8)	5 (7.7)	[a]	3 (4.5)
CCI						
0	29 (44.6)	[a]	25 (38.5)	3 (4.6)	[a]	1 (1.5)
1	17 (26.2)	[a]	13 (20.0)	2 (3.0)	1 (1.5)	1 (1.5)
2	7 (10.8)	1 (1.5)	4 (6.2)	2 (3.0)	[a]	[a]
3	4 (6.2)	[a]	2 (3.0)	1 (1.5)	[a]	1 (1.5)
4	4 (6.2)	[a]	2 (3.0)	2 (3.0)	[a]	[a]
5	1 (1.5)	[a]	1 (1.5)	[a]	[a]	[a]
6	2 (3.0)	[a]	1 (1.5)	[a]	[a]	1 (1.5)
7	[a]	[a]	[a]	[a]	[a]	[a]
8	1 (1.5)	[a]	[a]	1 (1.5)	[a]	[a]

ED emergency department, *RYGB* Open Roux-en-Y gastric bypass, *LRYGB* laparoscopic Roux-en-Y gastric bypass, *SG* sleeve gastrectomy, *LAGB* laparoscopic adjustable gastric band, *RBS* revisional bariatric surgery, *BMI* body mass index, *DM* type II diabetes mellitus, *HD* heart disease (heart failure, arrhythmia), *RF* renal failure, ∩ and, ∪ or, − not, *CCI* Charleson comorbidity indices

[a] No entry

which required operative interventions (2/361, 0.6%). Sixty-five patients required a total of 91 ED visits for an average of 1.4 visits per patient. Of these 65 patients, 46 were seen once, 14 twice, 4 were seen 3 times, and 1 was seen 4 times. The all-cause rate of ED visit, readmission, and reoperation occurring within 90 days of surgery was 18% (65/361). On average, patients returned to the ED on postoperative day (POD) 26.5 (range 2–90). Of note, 40.6% (37/91) of all ED visits

occurring within 90 days of surgery took place on a weekend (22 on Saturdays and 15 on Sundays).

Indications for ED Visits, Readmissions, and Reoperations

The indications for 91 ED visits, readmissions, and reoperations within 90 days of surgery are listed in Table 2. Nausea, vomiting, and/or diarrhea (NVD); abdominal pain, wound evaluations; and compliance issues accounted for over half (51.4%) of all ED visits. Of these 91 ED visits, 47% ($n = 43$; Table 3) were deemed preventable.

Seventy-five percent (12/16) of patient visits to the ED with NVD, 92% (11/12) of abdominal pain visits, 90% (9/10) of wound visits, and 67% (6/9) of visits attributable to postoperative non-compliance were deemed to be potentially preventable. In total, NVD, abdominal pain, wound evaluations, and compliance issues accounted for 88.4% of all preventable ED visits.

Table 2 Indications for 91 ED returns, readmissions, and reoperations

Indications	*n* (%)
Nausea, vomiting, dehydration	16 (17.5)
Abdominal pain	12 (13.2)
Wound issues	10 (10.9)
Compliance	9 (9.8)
A-fib/arrhythmia	4 (4.4)
GI bleed	4 (4.4)
Chest pain	3 (3.3)
Musculoskeletal pain	3 (3.3)
Urinary retention	3 (3.3)
Nephrolithiasis	3 (3.3)
Respiratory issues	3 (3.3)
Psych	2 (2.2)
SVT	2 (2.2)
Parotitis	2 (2.2)
Lower extremity cellulitis	2 (2.2)
Dysuria	2 (2.2)
Anastomotic leak	1 (1.1)
SBO (small bowel obstruction)	1 (1.1)
Gastric bezoar	1 (1.1)
Omental infarct	1 (1.1)
Groin abscess	1 (1.1)
Pancreatitis	1 (1.1)
Gout flare	1 (1.1)
Inguinal hernia	1 (1.1)
Headache	1 (1.1)
Abdominal pain from trauma	1 (1.1)
Otitis media	1 (1.1)

ED emergency department

Table 3 Indications for 43 ED returns deemed preventable

Indications	*n* (%)
Nausea, vomiting, dehydration	12 (27.9)
Abdominal pain	11 (25.6)
Wound issues	9 (20.9)
Compliance	6 (14.0)
Chest pain	2 (4.7)
SVT	2 (4.7)
GI bleed	1 (2.3)

ED emergency department

Discussion

We found that our rate of ED visits within 90 days of bariatric surgery was 18%. The most common reasons for preventable ED visits in our study were NVD, abdominal pain, wound evaluations, and dietary/behavioral non-compliance, accounting for almost 90% of ED visits. In reviewing the indications and clinical course of each ED encounter, anticipatory phone calls, changing practices in triage of patient phone calls, or interventions in the clinic could potentially have prevented 47% of these visits.

Unsurprisingly, several similar studies have reported comparable findings [8, 11]. This commonality in postoperative ED visits inspired our bariatric clinic to implement several systems changes detailed below.

Nausea, Vomiting, Dehydration

NVD is a common reason for ED visits following bariatric surgery [12]. In a study of 36,673 patients identified using administrative claims from large employers and health plans throughout the USA, Macht et al. found that of postoperative bariatric surgery patients returning to the ED within 90 days, 20.8% presented with NVD, second only to abdominal pain (24.4%) [8]. In our study, NVD was the most common reason for ED returns with a frequency of 17.5%. Furthermore, 75% of these visits were deemed to be potentially preventable.

There are a myriad of reasons patients experience NVD within 90 days following bariatric surgery. Patient poor compliance with dietary recommendations, dumping syndrome, and anastomotic stricture are among the differential diagnoses considered, and temporal relationships to surgery can help elucidate the etiology. Stricture formation at the gastrojejunal (GJ) anastomosis is not uncommon, occurring with an incidence as high as 4–6% is some studies [13, 14].

Whatever the etiology of NVD in postoperative bariatric surgical patients, the principles of management are to ensure hemodynamic stability and adequate fluid resuscitation. As our bariatric surgery program has evolved, we have constructed a clinic flow that allows for administration of IV fluid in the

outpatient setting for those patients who experience NVD and are hemodynamically stable. In addition to decreasing inefficient ED utilization, we have found that there are several advantages to this strategy. First, time to evaluation and treatment is anecdotally shorter for those patients that call our clinic instead of presenting to our ED. Second, because staff members familiar with bariatric patients evaluate these patients, potential etiologies such as anastomotic strictures or ulcers can be better characterized. Patients in whom GJ stricture is suspected are educated on the importance of staying hydrated and then scheduled for outpatient endoscopic evaluation and management within 24 h.

Abdominal Pain

Abdominal pain is one of the most common reasons for ED visits following bariatric surgery [15]. In a study of 283 patients returning to the ED within 90 days, Gonzalez et al. found that 46.2% returned with a primary complaint of abdominal pain [16].

The considerations for abdominal pain after bariatric surgery are diverse and present diagnostic and therapeutic challenges. Nevertheless, evaluation by practitioners familiar with bariatric patients, temporal relationships to surgery, and assessment of hemodynamics all function to narrow the differential.

We found that 13.2% of our postoperative patients returning to the ED presented with a principal diagnosis of abdominal pain. In 92% of these patients, no systemic illness, radiographic abnormality, or etiology was identified.

A study by Foster et al. suggested that compared to their lean counterparts, obese patients may be at higher risk for postoperative ED returns for evaluation of abdominal pain due to the fact that they experience abdominal symptoms more intensely [17]. Obese patients often have associated comorbidities such as anxiety and depression which plausibly may lower the threshold to seek medical attention for mild gastrointestinal symptoms [17]. Finally, patients who have recently undergone bariatric surgery are generally very aware that anastomotic leak is a potential complication of their operation, and without anticipatory guidance, they may be more likely to attribute mild pain to a potential sign of a serious complication and seek attention in the ED.

We have found that in the absence of hemodynamic instability or overt systemic illness, the majority of patients reporting abdominal pain can either be managed over the phone with education (e.g., when to escalate care to acute medical attention) and reassurance. Those patients that are stable but may need in-person evaluation are promptly scheduled for outpatient clinic assessment.

Wound Evaluation

Obesity is an independent risk factor for surgical site infections and wound complications following various procedures [18, 19]. It stands to reason that bariatric patients are at higher risk for postoperative wound complications. Among patients presenting to the ED following bariatric surgery, 5–14% of visits are due to wound complications [20, 21].

We found that almost 11% of our patients returning to the ED following surgery did so because of wound complications. Of these occurrences, 90% of visits were likely preventable.

Wound problems following bariatric surgery can be anxiety provoking for patients; however, the risk of wound infection as a marker for a more serious deep organ space infection from complications such as gastrointestinal leakage is exceedingly low (<1%) [22]. In our experience, the vast majority of wound evaluations result in a diagnosis of superficial site infection or postoperative seroma, neither of which routinely requires evaluation in an ED. In our practice, preventing returns to the ED for wound evaluations now begins with thorough education both preoperatively and prior to discharge. Patients are educated with both verbal and written information regarding signs and symptoms of infection and encouraged to call our clinic directly if concerned. Patients are often seen in clinic the same day and managed appropriately in the outpatient setting.

Compliance Issues

Several studies have found that patient non-compliance with diet and exercise preoperatively may predict even greater postoperative non-compliance [23, 24]. Fourteen percent of our patients returning to the ED with preventable causes did so because of compliance issues. Most were due to dietary non-compliance (i.e., insufficient hydration, eating too quickly, improper food choices, etc.)

Managing the non-compliant patient is difficult, and to date, there are no evidence-based guidelines addressing patient non-compliance following bariatric surgery. However, our clinic has now adopted the practice of frequent and early postoperative phone calls, especially for patients who may be identified preoperatively as being at risk, with the hope that anticipatory guidance may attenuate non-compliant behaviors.

Characteristics of ED Utilization

There are documented differences in outcomes for specific disease processes between patients presenting to the ED on the weekend versus the weekday. [25, 26] However, there is a paucity of literature characterizing weekend versus weekday ED utilization. In our study, we found that 40.6% of ED visits occurred on a Saturday or Sunday. We did not investigate the frequency at which ED visits occurred after clinical hours.

Interestingly, in a single institution study using Health Care Utilization Project (HCUP) data, Schoenfeld et al. found that weekend ED utilization increased by 32% while patient acuity was comparatively lower. [27] It is plausible that our findings represent part of a larger systemic healthcare delivery issue.

In light of these findings, extending ambulatory services to weekend and evening coverage may mitigate unnecessary ED usage. In our institution, however, the cost effectiveness of such a strategy was not investigated.

Limitations

There are several limitations to this study. While our electronic data warehouse captures all ED visits, which occur at our university hospital and its affiliated institutions, patients presenting to an ED other than our own may have been missed. As a new program, we began sending individual surgeon feedback on their 90-day institutional ED return rate in August 2015. Many of the outpatient strategies designed to mitigate return were implemented in the 6 months following release of these metrics, and as such, the objective data regarding the impact of the strategies mentioned above on decreasing patient return to the emergency department is currently lacking. Nevertheless, based on our early experiences and the feedback from our ED return rate metric, we have implemented systemic changes designed to improve quality in our program. A follow-up study is clearly warranted to ascertain whether our system changes have imparted a decrease in our ED returns.

Strengths

The present study is important for several reasons. While previous literature has focused on readmissions following bariatric surgery [21, 28, 29], less attention has been centered on preventable ED visits [8]. Furthermore, the majority of studies examining readmission and reoperation are often focused on the initial 30 days following surgery, potentially missing a significant portion of patients [20].

Additionally, our study contributes to the scarce body of literature attempting to characterize weekend versus weekday ED utilization. This growing composition of work is crucial in designing strategies aimed at reducing unnecessary ED usage.

Our findings reiterate the fact that a significant portion of postoperative ED visits occurring within 90 days of bariatric surgery are not only unnecessary, but more importantly, likely preventable [8, 11, 20, 29]. Compared to other large database studies, we were able to obtain a more granular view of the reasons for ED returns. From this more detailed analysis, we conclude that preventing unnecessary ED returns will likely involve the application of process-driven measures (e.g., ancillary staff trained in bariatrics to field calls, ability to provide IV hydration in clinic, etc.).

Finally, our study is unique in that we have identified targets for specific strategies aimed at attenuating inefficient ED utilization. Our practice is an average-sized bariatric program at a tertiary care medical center which caters to both a local urban population and rural patients spread throughout a four-state area of the Intermountain West, and therefore, our findings are likely generalizable to most urban and rural programs.

Conclusion

A significant portion of postoperative ED visits occurring within 90 days of bariatric surgery are not only unnecessary, but more importantly, likely preventable. Furthermore, the application of process-driven measures (e.g., ancillary staff trained in bariatrics to field calls, ability to provide IV hydration in clinic, etc.) would likely aid in preventing a significant portion of these ED visits, thus minimizing costly and inefficient utilization of the emergency department in the postoperative period. Healthcare institutions may find it valuable to support bariatric programs by granting the administrative and clinical resources described above, and thus, minimize costly and unnecessary utilization of the emergency department in the postoperative period.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Formal Consent For this type of study, formal consent is not required.

Informed Consent Does not apply.

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