Original article

Failure to Rescue After Abdominal Surgery: an Audit on Incidence and Predictors

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Abstract

Introduction

Failure-to-rescue (FTR), defined as death after a surgical complication, is a quality metric that is an important variable affecting mortality rates in hospitals. This study aims to analyze complications, FTR rates, and its predictors at the index hospital setting.

Methods

This was a retrospective cohort study performed at an academic hospital from 2015 to 2020 in the Department of Surgical Gastroenterology. We included all patients who had major complications following elective major benign or malignant abdominal surgeries. The primary and secondary endpoint was FTR rates and the overall major complications and deaths, re-operation rate, and its predictors respectively.

Results

Among 762 patients, the rate of any major complication was 14.9% . The overall mortality rate was 2.8%. However, the mortality rate among patients with complications was 27.4% (FTR). Twenty-seven (52.9%) patients underwent re-operation for complications, out of which 70% survived. Three (21.4%) patients had a delay in prompt diagnosis and interventions of complications and had FTR due to the anastomotic leak and bleeding. The ASA grade, co-morbidities,, re-operation, and nature of the disease (benign vs. malignant) did not predict the FTR.

Conclusion

This study conducted at an academic, low-volume center had higher rates of FTR. It can be further reduced by both prompt and appropriate interventions of postoperative complications in a multidisciplinary setup.

Keywords: Complications; Failure to rescue; Gastrointestinal Surgery; Hospital mortality.

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Introduction

Failure to rescue (FTR) is defined as in-hospital death following major complications.[1] Nowadays, it is an essential and best instrument to assess the surgeon and hospital outcome following any major surgeries, hence a measure of hospital quality of care.[2] Though FTR is dependent on broad patients factors, disease condition, surgeons experience, and hospital-related factors, it is assumed that if the surgery is performed in an academic, resource-rich, multidisciplinary center, FTR rate is reduced.[3]

FTR is a significant cause of mortality in Gastrointestinal (GI) Surgery. It is associated with a strong systemic inflammatory response after surgery and patients require an adequate body reserve to be able to meet the metabolic demands of surgery. No one is perfect; complications are known to happen and there is always a scope of improvement. FTR rate is a way to improve surgeons outcome. We took up this audit from an academic, low-volume tertiary center for the first time to investigate the FTR rates following major abdominal surgeries along with the associated factors predicting it.

Methods

The study is a retrospective review of all patients undergoing major abdominal surgery and had major complications. It was conducted from December 2015 to December 2020 in the Department of Surgical Gastroenterology. The inclusion criteria included all patients who had major complications following benign or malignant major abdominal surgeries. Those patients undergoing emergency abdominal surgery or referred from other centers following surgical complications were excluded. The major complications were defined as per the Clavien-Dindo classification. They were grade III (complications that require surgical, endoscopic, or radiological interventions) and grade IV (life-threatening) complications.

The primary endpoint of the study was to evaluate the incidence of failure to rescue (defined as in-hospital mortality among patients with complications or interventions required for complications) following abdominal surgeries. The secondary endpoint was the re-operation rate, etiology of failure to rescue, and its predictors. The study included demographic profile, ASA grade, co-morbidities, type of abdominal surgery (organ-specific), benign vs. malignant disease, complications in detail, complication which led to mortality and which did not, and overall mortality.

The statistical analysis was performed using Statistical Package for the Social Sciences (SPSS 11). Data were expressed as the mean (standard deviation), or the number (percentage). Continuous variables were compared for statistical differences using 2-sample Student t-tests. Categorical variables were tested for significance using the Chi-square test or Fisher exact test, as appropriate. A value of $P < 0.05$ was considered significant. This retrospective study was approved by our Institutional Review Board, and there wereis no conflict of interests.

Results

A total of 762 major abdominal surgical procedures were identified during the study period. The majority of the procedures performed were pancreatectomy. Out of 762 surgeries, 51(14.94%) patients developed major complications. The mean age of patients with complications was 47.9 ±16.3 years (range: 12-80 yrs), with a male: female ratio of 2:1. On subgrouping the patients with major complications based on the type of abdominal surgeries, they were: pancreatectomy (16), biliary (13), esophagogastric resection (8), colorectal resection (8), and liver resection (6). There were 26 (50.9%) benign and 25 (49.1%) malignant surgeries. The majority of complications observed in the study were surgical: bleeding, leak, postoperative obstruction, sepsis, cholangitis, and pulmonary complications. The overall mortality in the entire group of operated patients was 2.88%. However, failure to rescue after complications was observed in 14 (27.4%) patients. All FTR was due to surgical complications, except two medical complications due to the myocardial infarction and pulmonary embolism. Out of the 14 patients with FTR, 11 (78.5%) patients were in high ASA grade (≥III), 8 (57.1%) with co-morbidities, 7 (50%) in shock after surgery, and 9 (64.28%) patients with malignant disease. Among the 51 patients, 27 (52.9%) patients required re-operation for any form of major complications, out of which FTR occurred in 8 (29.6%). The majority (70%) of our patients survived following re-operation. However, there was a delay in diagnosis and interventions in 3(21.4%) among the 14 patients with FTR due to the anastomotic leak and bleeding. All three died because of renal failure following re-operation. The major complications in detail with FTR is depicted in **Table 1**.

The causes of FTR were:

1. Pancreaticojejunal anastomotic leak and sepsis (1), Bleeding following pancreatectomy and artery/vein resection (1), leak from feeding jejunostomy site (1), hepaticojejunal (HJ) anastomosis leak following total pancreatectomy (1).
2. Liver resection- post hepatectomy liver failure with bile leak at 4th week (1); Pulmonary embolism in extended right hepatectomy (1); portal biliopathy surgery- HJ leak (1).
3. Duodenal stump leak with sepsis in subtotal gastrectomy (3); Gastrojejunal anastomosis leak in subtotal gastrectomy with COVID-19 infection (1).
4. Extended cholecystectomy with enbloc transverse colectomy for Gallbladder cancer with colonic infiltration- sepsis due to anemia, hypoalbuminemia, and poor general profile (1).
5. Right hemicolectomy for adenocarcinoma ascending colon- sepsis, poor general condition (1).
6. Esophageal anastomosis leak and sepsis (1) following subtotal esophagectomy.

There was no significant difference in the mean age of patients who could be rescued or not (47.7 vs. 48.4 p=0.9). On the evaluation of risk factors of failure to rescue,

Table 1. Postoperative major complication in details in patients who survived and with Failure to rescue (FTR)

Type of Operation	Major Complications	Survived (n=37)	FTR (n=14)
Pancreatectomy	Pancreatojejunal anastomotic leak with sepsis	5	1
	Bleeding	6	1
	Efferent loop obstruction	1	-
	Leak from feeding jejunostomy site	-	1
	Hepaticojejunal (HJ) anastomosis leak	-	1
Esophagogastric resection	Gastrojejunal anastomotic leak	-	1
	Duodenal stump blow-out	1	3
	Bleeding	1	-
	Chest infection	2	-
	Early small bowel obstruction	1	-
	Esophagogastric anastomotic leak	-	1
Biliary	Bile leak	6	-
	Bleeding (liver bed)	2	-
	Sepsis/Cholangitis	2	1
Liver resection	Bile leak and cholangitis	2	1
	Posthepatectomy liver failure	1	1
	Bleeding	1	-
	Pulmonary embolism	-	1
Colorectoal resection	Anastomosis leak	3	-
	Sepsis (no leak)	1	1
	Ureteric injury	1	-
	Pelvic bleeding	1	-

none of the parameters like high ASA, presence of co-morbidities, shock, benign vs. malignant disease, need for re-exploration and delayed interventions were statistically significant (**Table 2**).

Discussion

Our analysis of large series of 762 patients revealed 15% (51 patients) major complications rates and FTR rates of 27%, which (though in higher side) is in line with various international analysis of complex surgical procedures.[3-5] The study had 53% (27 patients) re-exploration following major complications, and the majority (70%) survived. Unfortunately, there were three (21%) deaths due to renal failure following re-operation for the major surgical complications where the complication recognition and management were delayed. The FTR rates following major abdominal surgeries vary between the centers and the type of surgery, however, it ranges between 9%-30%.[3,4] Our higher side mortality suggests the need to focus on processes related to the prompt recognition and management of major postoperative complications. This requires the "attitude" of the clinical staff, residents, intensivists, and treating surgical care units to respond quickly and effectively to all postoperative complications.[3]

The concept of FTR was first introduced by Silber et al and later popularized by Ghaferi and colleagues.[3,6] They suggested that quality of care is more appropriately approximated by how a complication is managed once it occurs. Further, the FTR is associated with hospital characteristics rather than the patient factors, which provides us insight into why the FTR is low in higher volume compared to the low-volume centers.[4,7]

Table 2. Evaluation of risk factors of failure to rescue (FTR).

Parameters	Total (51)	Survived (37)	FTR (14)	P value
High ASA	31 (60.8%)	20 (54.1%)	11 (78.6%)	0.11
Co-morbidity	28 (54.9%)	20 (54.1%)	8 (57.1%)	0.84
Shock	15 (29.4%)	8 (21.6%)	7 (50.0%)	0.08*
Benign disease	26 (51.0%)	21 (56.8%)	5 (35.7%)	0.18
Malignant disease	25 (49.0%)	16 (43.2%)	9 (64.3%)	0.18
Unplanned re-exploration	27 (52.9%)	19 (51.4%)	8 (57.1%)	0.71
Delayed intervention	7 (13.7%)	4 (10.8%)	3 (21.4%)	0.38**

*Fischer exact test **Chi- square test

The variation in FTR rates across hospitals depends on "macro system hospital resources" which includes ICU staffing (both quantity and quality), rapid response team, and presence of certified intensivists, high-technology equipped, hospital procedural volume, and teaching status.[2,3,5,6] The majority of the deaths in the present series were due to renal failure compounded by sepsis, which nowadays is uncommon due to the availability of adequate ventilators, continuous renal replacement therapy (CRRT) in intensive care units, and higher broad-spectrum antibiotics. Our patients tolerate complications to some point, but due to the poverty, financial constraints, lack of health insurance coverage, limited high-technology hospital resources, patients give upoff and ultimately succumbs. Furthermore, the high death rates could also be attributed due to the majority of "high-risk" surgery the patient underwent (e.g. pancreatectomy, esophagectomy,subtotal and total gastrectomy, major liver resection).[8]

The factors predicting high FTR also include linear increase in age of the patients, body mass index (BMI), ASA status, presence of shock, multiple complications, malignancy, and presence of co-morbidities.[9] However, in the present study, none of the factors predicted the high death rates following major complications.

We tool up this study because FTR is one mechanism for identifying ways to improve care. It should be routinized in all centers for monitoring both complications and deaths, which gives us the opportunity for improvement in facilities and health systems, building capacity in resource-limited settings, and developing a "culture of safety" among treating surgical units.

Conclusion

Major abdominal surgery has an inherent risk of complications and death. The present study conducted at an academic, low-volume center had higher rates of FTR of 27%. It can be further reduced by both early and appropriate surgical and non-surgical interventions of postoperative complications in dedicated units with their greater experience and resources.

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