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Mortality and morbidity rates in patients undergoing emergency laparotomy: an analysis in a tertiary care hospital

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ABSTRACT

Background: Emergency Laparotomy is a complex and often time-critical surgical procedure associated with significant morbidity and mortality. Emergency abdominal surgery is performed in most hospitals, and acute laparotomy is considered a high-risk procedure with significant mortality rates ranging from 14% to 20%. This study is done to assess the mortality and morbidity rates in patients undergoing emergency laparotomy at a tertiary care hospital over a period of 1 year and to identify risk factors associated with it. **Aims and Objectives:** To assess the mortality and morbidity rates in patients undergoing emergency laparotomy at a tertiary care hospital. **Materials and Methods:** This is a prospective observational study conducted in the department of general surgery at KR hospital during the period of January 2020 to December 2020. All the patients who underwent emergency laparotomy were included in the study. Patient was followed during the pre-operative, intraoperative and post-operative period and demographic data, comorbidities, habits were collected pre-operatively. Post-operatively, the complications were identified and classified based on the Clavien-Dindo classification. Cox proportional hazards model was used to identify risk factors for mortality and morbidity. **Results:** A total of 478 patients underwent emergency laparotomy, of whom 18% had surgical complications and 23% had medical complications. The overall 30-day mortality was 20.3%. The overall death rate within 24 h of surgery was assessed. Several risk factors for 30-day mortality were identified: age, ASA >3, performance score, etc. **Conclusion:** A complete analysis of complications and mortality in a consecutive group of patients undergoing laparotomy was done and found that almost one in five patients died after emergency laparotomy. Predictors of poor outcome and several risk factors for mortality and morbidity were identified.

Key words: Clavien-Dindo classification; Emergency laparotomy; Morbidity; Mortality; Risk factors

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INTRODUCTION

Emergency Laparotomy is a complex and often time-critical surgical procedure associated with significant morbidity and mortality. Care of patients who undergo emergency laparotomy often involves input from multiple specialties including Emergency Medicine, Surgery, Anesthesiology, Radiology, Critical Care Medicine, and Medicine for the Elderly.[1] Emergency abdominal surgery is performed in most hospitals, and acute laparotomy is considered a high-risk procedure with significant mortality rates ranging from 14% to 20%.[2]

Although the underlying pathology varies, patients undergoing EL can be seen as a subgroup in the field with high mortality, especially among the elderly with comorbidity.[3,4] There is limited evidence regarding the optimal treatment of patients undergoing emergency surgery.[5]

However, the literature is very limited with respect to the detailed presentation and the morbidity and mortality and

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the surgical complications in the post-operative period. The objective of this study is to give a detailed analysis of morbidity and mortality in a group of patients undergoing emergency laparotomy over a period of 1 year in a tertiary care hospital.

Aims and objectives

To assess the mortality and morbidity rates in patients undergoing emergency laparotomy at a tertiary care hospital.

MATERIALS AND METHODS

A prospective observational study was conducted over a period of 12 months between January 2020 and December 2020 at Krishnarajendra hospital, Mysore Medical College and Research Institute on over 478 patients who underwent emergency laparotomy for acute abdominal conditions. The study was pre-approved by the Institutional Ethics Committee (IEC) for the final permission. After obtaining the permission of IEC the study was conducted.

All the patients who underwent emergency laparotomy was included in the study. During the 1-year period, a total of 478 patients were admitted in the department of surgery who underwent emergency laparotomy. Following admission, data was collected, including the demographic data, comorbidities, risk factors such as smoking and alcohol, and performance score. Pre-op, intra-op, and post-op follow-up of the patient was done including the post-operative complications. 30-day morbidity, 30-day mortality, and length of stay was assessed. In this study, the post-operative complications were classified according to the Clavien-Dindo classification (CD). The CD grades any deviation or complication in the post-operative period according to severity and type of management and is widely used for reporting complications after elective surgery.[6-8] The post-operative complications were considered minor if the CD score was 1–2. Such a score arises from any complications handled in the surgical ward, for example, blood transfusion, correction of electrolytes, superficial wound infections, antibiotic treatment, etc. Complications were considered severe if the CD score was 3–5 and include any complications demanding surgical, radiological, or endoscopic interventions, and/or any complication requiring intensive care unit management. Grade 5 is death of the patient. Performance score was defined as the patient's level of function and capacity for self-care according to Zubroed/WHO classification.[9,10]

Statistical analysis

Data was entered in Microsoft Excel v.2019 and was analyzed using trial version of Statistical Package for the Social Sciences version 25. Continuous data (e.g. Age) were represented as mean, with variation explained with the help of standard deviation. Categorical data (e.g. Gender) were represented as frequencies and percentages. Cox proportional hazards model was used to analyze the mortality data (30-day mortality) and hazards ratio was noted to identify the risk factors. In addition, binomial logistic regression analysis was used to assess the magnitude of risk factors associated with post-operative complications, be it overall or separately for surgical or medical morbidities.

RESULTS

Patient population

During the 1-year period of the study, 478 patients underwent emergency laparotomy after admission to the surgery department. The mean age was 42.99 years, 76.2% were male and 23.8% were female. About 6.7% of patients had intake of alcohol more than recommended and 41.2% were smokers. The most common comorbidity in the patients was diabetes mellitus (19.2%), followed by hypertension (15.1%), obstructive pulmonary disease (7.3%), malignancy (5.6%), and ischemic heart disease (4%). The demographics, comorbidities, and medications are shown in Table 1. ASA Score was >3 in 30.1% of the cases. Performance score was >3 in 1.7% cases. (Table 2).

Procedure

The most common procedure performed was modified omental patch repair for gastric and duodenal perforations (32%), followed by appendectomy (30.3%), small bowel resection, and ileostomies (Table 3). The length of hospital stay was on an average of 6.86% (Table 3).

Mortality

The overall mortality was 20.3% (97/478). Death within the 1st post-operative day occurred in 23 patients. Most of these patients had severe septic shock and multi-organ failure or died of respiratory failure. The cause of death was because of medical complications in 20.6% and because of surgical complications in 23.7% of patients. The overall procedure-related 30-day mortality is shown in Table 3. The 30-day mortality was 20.3% (by procedure: 26.8% omental patch repair, 28% small bowel ostomies, 54.5% large bowel ostomies, and 48% small bowel resection). To estimate risk factors for 30-day mortality, a multivariate Cox proportional hazards analysis was performed. The analysis assessed gender, age, ASA score ≥3, performance status ≥3, and comorbidities: Diabetes Mellitus, hypertension, COPD, malignancy, IHD, thyroid disorder, CKD, tuberculosis, CVD, liver diseases, and epilepsy. Several predictors for death were estimated. Predictors on 30-day mortality were advancing age, performance status >2, ASA Score >3, comorbidities such as diabetes mellitus and ischemic heart disease, and alcohol consumption (Table 4).

Table 1: Demographic details of the study participants

Variable	Categories	Frequency	Percentage (%)
Age (Mean [SD])		42.99 years (16.06 years)	
Age	<20 years	23	4.8
	20–39 years	176	36.8
	40–59 years	183	38.3
	60–79 years	92	19.2
	>80 years	4	0.8
Gender	Female	114	23.8
	Male	364	76.2
Smoking	Present	197	41.2
	Absent	281	58.8
Alcohol consumption	Present	32	6.7
	Absent	446	93.3
Comorbidities*	Diabetes Mellitus	92	19.2
	Hypertension	72	15.1
	Obstructive pulmonary disease	35	7.3
	Malignancy	27	5.6
	Ischemic Heart disease	19	4.0
	Thyroid disorder	14	2.9
	Chronic Kidney Disease	5	1.0
	Tuberculosis	5	1.0
	Cerebrovascular disorders	4	0.8
	Liver diseases	4	0.8
	Epilepsy	2	0.4
	COVID-19	1	0.2
Medications*	Amlodipine	2	0.4
	Insulin	1	0.2
	Anti-tubercular drugs	1	0.2

*Frequencies may not add up to the sample size as the categories are not mandatory and are not mutually exclusive.

Table 2: Physical status of the study participants

Scoring system	Categories	Frequency	Percentage (%)
ASA physical status classification	Score<III	334	69.9
	Score≥III	144	30.1
WHO performance status	0	52	10.9
	1	304	63.6
	2	114	23.8
	3	8	1.7
	4	0	-

ASA: American Society of Anesthesiologists

Complications

One or more post-operative complications occurred in 27% of the patient. Post-operative morbidity is shown in Table 5. Of the 478 patients, 18% had surgical complications and 23% had medical complications. The most common surgical complication was wound infection, followed by wound dehiscence. Anastomotic leakage was seen in 16 cases out of 73 'resection and anastomosis' surgeries amounting to 21.9% of anastomotic leakage. The most common medical complication was respiratory complications followed by renal complications. The severe pulmonary complications consisted of pneumonia and pleural effusion. Among the renal complications, 90% cases were of acute renal failure/acute tubular necrosis. Predictors on 30-day morbidity were ASA Score >3, comorbidity such as diabetes mellitus and malignancy. (Table 6). The predictors were further divided based on the surgical and medical morbidity and the risk factors were identified. (Table 7).

DISCUSSION

The general surgical population is broad group of patients suffering from a wide range of conditions and existing comorbidities. Outcomes vary within this very heterogeneous group of patients. However, it has been well established that emergency surgery has a high risk of postoperative complications other than death, ranging from relatively minor complications such as ileus to severe complications, such as wound infection or stroke.[11,12] The presence of co-existing medical disease is of great importance for the prognosis of patients undergoing emergency surgery. Age, ASA class, functional status, and presence of sepsis have been shown to predict death, and several studies have tried to develop scoring systems in order to be able to predict outcome by scoring pre-operative status however, literature is not consistent concerning the impact of comorbidities in general.[13,14-16] We found the presence of diabetes mellitus, hypertension, cerebrovascular disease, cardiopulmonary conditions, chronic nephropathy, and malignancy to influence the 30-day mortality.

Table 3: Procedures performed, hospital stay, and procedure-related 30-day mortality

Type of surgery	Individuals who underwent the surgery (n=478) (Frequency [Column Percentage])	Procedure-related 30-day Mortality (n=97) (Frequency [Surgery-wise Percentage])	Mean (SD) post-operative days in hospital	
			Overall subjects	Subjects who expired
Appendectomy	145 (30.3%)	0	2.66 (1.60)	NA
Omental patch repair	153 (32.0%)	41 (26.8%)	7.11 (2.99)	4.07 (2.09)
Small bowel ostomies	50 (10.5%)	14 (28.0%)	10.54 (4.95)	8.07 (5.18)
Large bowel ostomies	11 (2.3%)	6 (54.5%)	9.09 (4.21)	7.67 (4.50)
Small bowel resection	50 (10.5%)	24 (48.0%)	9.08 (5.59)	6.63 (5.60)
Large bowel resection	23 (4.8%)	4 (17.4%)	13.61 (6.39)	6.50 (7.18)
Primary repair	17 (3.6%)	1 (5.9%)	8.18 (2.74)	1.00
Band release	2 (0.4%)	0	9.00 (1.41)	NA
Splenectomy	11 (2.3%)	2 (18.2%)	8.18 (2.71)	4.00 (2.83)
Cholecystectomy	3 (0.6%)	0	13.33 (6.11)	NA
Abscess drainage	5 (1.0%)	3 (60.0%)	10.20 (4.32)	9.00 (5.29)
Others*	8 (1.7%)	2 (25.0%)	9.50 (8.04)	4.50 (3.54)
Total	478 (100.0%)	97 (20.3%)	6.86 (4.85)	5.73 (4.42)

*Others 9: include Release, Hartmann's procedure, Excision of mesenteric cyst, 2 peritoneal lavages (1 death), Reduction and closure, Spontaneous reduction, excision with hysterectomy (1 death).

Table 4: Risk factors for 30-day mortality after surgery

Variable	Categories	HR (30-day mortality)	95% CI	P value
Age	<20 years	Ref (1)		
	20–39 years	1.990	0.267–14.853	0.502
	40–59 years	3.004	0.418–22.195	0.272
	60–79 years	4.357	0.594–31.936	0.148
	> 80 years	10.247	1.062–98.879	0.044*
Gender	Male	Ref (1)		
	Female	1.328	0.844–2.087	0.220
Smoking	Absent	Ref (1)		
	Present	1.173	0.787–1.749	0.443
Alcohol consumption	Absent	Ref (1)		
	Present	1.840	1.057–3.203	0.031*
Comorbidities	Diabetes Mellitus	1.619	1.047–2.504	0.030*
	Hypertension	1.500	0.916–2.457	0.107
	COPD	1.455	0.775–2.730	0.243
	Malignancy	1.116	0.570–2.181	0.749
	IHD	2.132	1.067–4.258	0.032*
	Thyroid disorder	0.385	0.054–2.766	0.343
	CKD	2.641	0.834–8.364	0.099
	Tuberculosis	0.572	0.079–4.122	0.579
	CVD	1.303	0.181–9.359	0.793
	Liver diseases	2.019	0.496–8.215	0.326
	Epilepsy	2.154	0.299–15.489	0.446
ASA physical status classification	Score < III	Ref (1)		
	Score ≥ III	4.354	2.814–6.735	< 0.001*
WHO performance status	0	Ref (1)		
	1	4.822	0.661–35.170	0.121
	2	14.258	1.967–103.368	0.009*
	3	31.744	3.897–258.565	0.001*
	4	-		

HR: Hazards' ratio, CI: Confidence Interval, ASA: American Society of Anesthesiologists. *P value significant at<0.05

Only one previous study, in Finland,[8] retrospectively analyzed a smaller group (n=444) of emergency surgical patients and validated the Clavien-Dindo classification for emergency surgical patients. They found a mortality rate of 18.2% in the patients undergoing laparotomy.

A large retrospective study from the USA[3] with 37,553 patients found an overall 30-day mortality rate of 14% and of more than 50% with ASA IV or V, dependent functional status and septic shock, and <10% chance of survival in the same group for those aged 90 or more. Advancing age and performance status were found to be strong, independent predictors for increased morbidity and 30-day mortalities. One study reported cardiopulmonary incidents in 26% of laparotomies, and post-operative respiratory incidents have been described as between 5%

Table 5: Post-operative complications listed as per Clavien-Dindo classification

Complications (Clavien-Dindo classification)	Frequency	Percentage (among total surgeries)
Surgical complications		
Bleeding	10	2.1%
Fascia dehiscence	22	4.6%
Ileus	10	2.1%
Wound infection	26	5.4%
Intraabdominal abscess	0	-
Anastomotic leakage*	16	3.3%
Others	15	3.1%
Medical complications		
Neurological	4	0.8%
Respiratory	68	14.2%
Cardiac	12	2.5%
Gastrointestinal	5	1.0%
Renal	23	4.8%
Thrombo-embolic	2	0.4%

*Anastomotic leakage was seen in 16 cases out of 73 'resection and anastomosis' surgeries amounting to 21.9% of anastomotic leakage.

Table 6: Risk factors for 30-day morbidities (all morbidities considered) after surgery

Variable	Categories	OR (30-day morbidity)	95% CI	P value
Age	<20 years	Ref (1)		
	20–39 years	1.076	0.427–2.711	0.876
	40–59 years	1.435	0.581–3.541	0.433
	60–79 years	1.411	0.566–3.514	0.460
	>80 years	2.612	0.620–11.008	0.191
Gender	Male	Ref (1)		
	Female	1.001	0.723–1.386	0.997
Smoking	Absent	Ref (1)		
	Present	1.221	0.932–1.601	0.148
Alcohol consumption	Absent	Ref (1)		
	Present	1.026	0.673–1.564	0.904
Comorbidities	Diabetes Mellitus	1.487	1.101–2.010	0.010*
	Hypertension	1.302	0.908–1.868	0.151
	COPD	1.391	0.891–2.169	0.146
	Malignancy	0.597	0.369–0.967	0.036*
	IHD	1.040	0.548–1.973	0.904
	Thyroid disorder	0.725	0.231–2.275	0.581
	CKD	2.461	0.908–6.669	0.077
	Tuberculosis	0.799	0.296–2.159	0.658
	CVD	1.591	0.222–11.404	0.644
	Liver diseases	0.865	0.214–3.492	0.839
	Epilepsy	0.972	0.136–6.961	0.978
ASA physical status classification	Score < III	Ref (1)		
	Score ≥ III	1.579	1.204–2.070	0.001*
WHO performance status	0	Ref (1)		
	1	1.243	0.629–2.457	0.532
	2	1.489	0.742–2.988	0.262
	3	2.400	0.921–6.256	0.073
	4	-		

OR: Odds' ratio, CI: Confidence Interval. *P value significant at<0.05.

and 10% following abdominal surgery, with the higher rate in the emergency surgery group.[17-19]

A multicenter trial carried out in 2013[20] randomized patients undergoing major abdominal surgery to either preoperative lung-protective ventilation with the use of low tidal volumes and positive-end expiratory pressure or to standard mechanical ventilation. They showed that the intervention significantly reduced major pulmonary complications within the first post-operative week from 27.5% to 10.5%.

Limitations of the study

The present study has some limitations. The sample size was small.

Table 7: Risk factors for 30-day morbidities (all morbidities considered) after surgery

Variable	Categories	30-days surgical morbidity			30-days medical morbidity		
		OR	95% CI	p value	OR	95% CI	P value
Age	<20 years	Ref (1)			Ref (1)		
	20–39 years	2.600	0.350–19.335	0.351	0.697	0.242–2.007	0.504
	40–59 years	3.143	0.430–22.959	0.259	1.006	0.362–2.796	0.990
	60–79 years	3.562	0.486–26.092	0.211	0.866	0.304–2.467	0.787
	>80 years	5.011	0.310–80.936	0.256	1.955	0.355–10.768	0.441
Gender	Male	Ref (1)			Ref (1)		
	Female	1.109	0.699–1.759	0.661	0.908	0.573–1.439	0.681
Smoking	Absent	Ref (1)			Ref (1)		
	Present	0.799	0.535–1.195	0.274	1.770	1.211–2.587	0.003*
Alcohol consumption	Absent	Ref (1)			Ref (1)		
	Present	0.464	0.202–1.062	0.069	1.655	1.004–2.727	0.048*
Comorbidities	Diabetes Mellitus	1.788	1.162–2.752	0.008*	1.261	0.826–1.925	0.283
	Hypertension	1.299	0.756–2.230	0.343	1.305	0.804–2.119	0.281
	COPD	0.786	0.394–1.571	0.496	1.487	0.832–2.656	0.181
	Malignancy	0.588	0.301–1.152	0.122	0.607	0.304–1.213	0.157
	IHD	1.285	0.555–2.976	0.559	0.815	0.300–2.212	0.688
	Thyroid disorder	1.888	0.590–6.037	0.284	0.048	0–13.292	0.289
	CKD	3.355	0.813–13.850	0.094	1.944	0.477–7.920	0.354
	Tuberculosis	1.205	0.379–3.836	0.752	0.399	0.055–2.866	0.361
	Liver diseases	0.927	0.129–6.682	0.940	0.811	0.113–5.826	0.835
	Epilepsy		NE		2.549	0.354–18.374	0.353
	CVD		NE		1.516	0.211–10.911	0.679
ASA physical status classification	Score < III	Ref (1)			Ref (1)		
	Score ≥ III	1.378	0.924–2.054	0.116	1.775	1.227–2.568	0.002*
WHO performance status	0	Ref (1)			Ref (1)		
	1	0.900	0.358–2.267	0.824	1.667	0.605–4.595	0.323
	2	1.007	0.390–2.599	0.988	2.21	0.756–5.949	0.153
	3	1.807	0.481–6.794	0.381	3.103	0.771–12.485	0.111

OR: Odds' ratio, CI: Confidence Interval, NE: Non-existent. *P value significant at<0.05

Laparoscopic procedures were not included in the study.

CONCLUSION

A complete analysis of complications and mortality in a consecutive group of patients undergoing laparotomy was done and found that almost one in five patients died after emergency laparotomy. Predictors of poor outcome and several risk factors for mortality and cardiopulmonary events were identified and Age and performance status can be tools to help predict survival. We found the emergency surgical population to be greatly heterogeneous and preventing or minimizing cardiopulmonary complications demands the optimal per and post-operative surveillance and care. Patients should be assessed and post-operatively closely monitored, since it is likely that post-operative complications might be detected earlier, and so treated in time which might increase survival. Clavien-Dindo classification can be used for monitoring post-operative morbidity and mortality and there is a need for high-quality prospective and multimodal intervention studies in order to improve patient care in this large group of patients.

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Authors Contribution:
MP- Concept and design of the study, prepared first draft of manuscript; **SHB-** Interpreted the results; reviewed the literature and manuscript preparation; **FS-** Concept, coordination, statistical analysis and interpretation, preparation of manuscript and revision of the manuscript

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