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Incidence and Risk Factors of Morbidity and Mortality in Emergency Laparotomy

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ABSTRACT

Background: The indications for emergency laparotomy are many, depending on different pathological causes, organs involved, and preoperative management. All these factors limit the time to optimize the comorbidities that may affect the outcome of surgery in terms of morbidity and mortality.
Objectives: We aimed to detect the different predicting factors for morbidity and mortality after emergency laparotomies.
Materials and methods: This prospective cohort study was conducted on 100 patients who were subjected to an emergency laparotomy. The demographic and clinical characteristics of the enrolled participants were registered. The study was carried out at Duhok Emergency Teaching Hospital from February 2022 to January 2023. Patients were followed for 30 days after surgery.
Results: The mean age of the patients was 39.26 years ± 19.53, and males constituted 2/3rd of the cases. The non-traumatic causes comprised the majority of cases. Patients with acute abdomen and intestinal obstruction comprised 74% of the cases. The commonest imaging finding was intra-abdominal collections (35%). The commonest operative finding was perforated gastric or duodenal ulcer (19%). Morbidity was reported in 69 patients. These included wound infection, anastomotic leakage, bleeding, deep venous thrombosis, and burst abdomen. There was a significant association (P-value < 0.05) between the morbidity and the age of the patient (OR: 1.5), body weight (OR: 1.9), associated comorbidities (OR: 1.2), operative time (OR: 1.76), performance of bowel anastomosis (OR: 5.5), and admission to the intensive care unit (ICU) (OR: 2.79). Mortality was reported in 9 patients, and there was a significant association (P-value < 0.05) with anastomotic leakage (OR: 4.27), need for anti-coagulation (OR: 23.65), and admission to the ICU (OR: 16.36).
Conclusion: Emergency laparotomy is associated with high incidences of morbidity and mortality. The patient's age, body weight, associated comorbidities, operative time, performance of bowel anastomosis, and admission to the ICU might be risk factors for morbidity. High mortality might be due to anastomotic leakage, the requirement of anticoagulation, and ICU admission.
Keywords: Laparotomy; Emergency laparotomy; Abdominal trauma; Intestinal obstruction; Anastomotic leakage.

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INTRODUCTION

The term laparotomy is used to describe any surgery requiring the opening of the abdominal wall and exploration of the underlying structures. Elective laparotomy indirectly implies that there is ample time for preoperative assessment and preparation of the patient. On the other hand, an emergency laparotomy is a lifesaving procedure, undertaken mostly in acute cases without much preparation of the patient. Emergency laparotomy is performed for a variety of emergency surgical presentations with different underlying pathologies, anatomical sites of surgery, and perioperative management. These variations in surgical pathology and the emergency presentation are usually coupled with the limited time to optimize the associated co-morbidities and are likely to contribute significantly

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to postoperative morbidity and mortality [1–3].

Recommendations to improve the outcomes of emergency surgeries include a high level of care determined by formal risk stratification, good perioperative resuscitation and optimization, early control of the source of sepsis, consultants for high-risk patients and those with comorbidities, prioritization of emergency operation cases, and access to postoperative critical care [4, 5].

Appropriate optimization of the patient's conditions includes timely administration of antibiotics, fluid resuscitation and electrolyte balance, omitting and/or optimizing medications, nutritional support, good glycemic control, and perioperative physiotherapy [6].

The overall outcomes after emergency laparotomy are usually poor, with an almost complete absence of scientifically based patient care pathways. This applies especially to the postoperative period. The potential for establishing a proper enhanced recovery protocol may reduce the associated negative outcomes. Advanced age, abnormal parameters in blood tests such as low platelets and low albumin, and the need for intensive care unit (ICU) admission are found to be associated with unfavorable outcomes after emergency laparotomy [7, 8].

Mortality and morbidity occur commonly following an emergency laparotomy, and incur a considerable clinical and financial healthcare burden. Limited data has been published describing the postoperative course and temporal pattern of complications after an emergency laparotomy. The development of complications cause a major burden both financially and clinically on hospital and healthcare workers [9]. Hence, this study was conducted to assess the different predicting factors for morbidity and mortality following emergency laparotomies.

MATERIALS AND METHODS

This is prospective cohort study was carried out at Duhok Emergency Teaching Hospital in Duhok City, Kurdistan region, Iraq. The current study covered the period from the 1st of February 2022 to the 31st of January 2023.

Data were collected from both trauma and non-trauma patients who underwent laparotomy consequently by a specially designated questionnaire. A complete history and physical examination were done for each patient, including any chronic illnesses, smoking status, history of chronic steroid intake, abdominal pain, nausea, vomiting, and the type of injury. A thorough clinical examination, including the vital signs, weight of the patient, general and abdominal examination, and any treatment that was received, particularly blood transfusion. Then detail of the investigations, the duration of the operation, and details of the surgery such as the type of incision, type of pathology, medications received during and after surgery, any admission to the ICU, and postoperative complications such as deep venous thrombosis, pulmonary embolism, anastomosis leaking, bleeding, re-laparotomy, wound infection, burst abdomen, and death.

Patients were followed for 30 days after surgery. Adult patients (of both genders) who were admitted to Duhok Emergency Hospital and required laparotomy were included in this study. While those below 18 years of age, those who declined to participate or skipped from follow-up were excluded.

Ethical approval is granted from the Kurdistan Board for Medical Specializations on January 1, 2021 with a reference number of 29180968. Informed consent was obtained from all participants in this study.

These data were analyzed and correlated to various patient characteristics displayed in terms of frequency, mean, median, and standard deviations. The correlation was done using the independent t-tests, the Chi-square test (χ^2), and Fisher's exact test. In the results of the analyses with a 95% confidence interval, P-values < 0.05 will be considered a statistically significant difference. The statistical calculations will be done using the Statistical Package for Social Sciences (SPSS, IBM: USA) version 25.

RESULTS

The mean age of the patients is 39.26 years ± 19.53, and males constituted around 2/3rd of the cases (Figure 1).

None-traumatic cases were the most common group of patients who underwent emergency laparotomies (patients with acute abdomen and intestinal obstruction were 74%), as shown in Figure 2.

The commonest finding following different imaging modalities and endoscopies was intra-abdominal collections in 35% (Figure 3).

During emergency laparotomy, the commonest finding was perforated gastric or duodenal ulcers in 19%, followed by intestinal obstruction in 18%, perforated appendix or large bowel in 13%, and bowel injuries in 12%, followed by other different findings in order of decreasing frequencies (Table 1).

In our study, morbidity was reported in 69 patients. The morbidity included wound infection, anastomotic leakage, bleeding, deep venous thrombosis, and burst abdomen. There was a significant association between the morbidity and the age of the patient, patient's weight, associated comorbidities, duration of the operation, performance of bowel anastomosis during surgery, and admission to the ICU. While the association was not significant with other factors such as gender, smoking status, steroid intake, hemoglobin level, type of incision, and the indication of emergency laparotomy, whether trauma or non-trauma cases (Table 2).

In our study, mortality was reported in 9 patients, and there was a significant association between mortality and

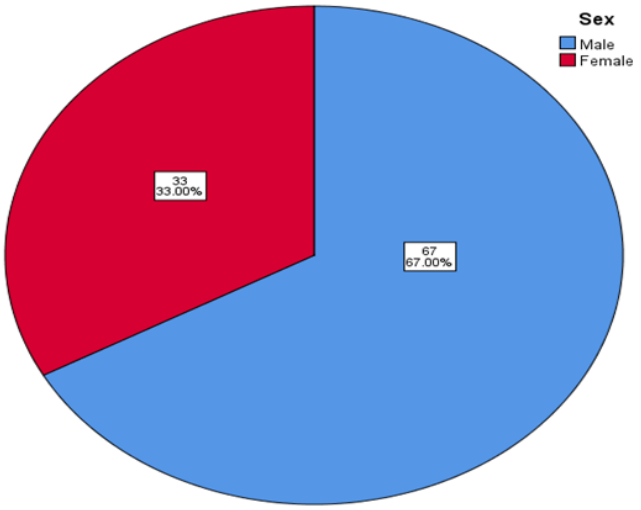

Figure 1. The distribution of the genders of 100 patients with emergency laprotomy.

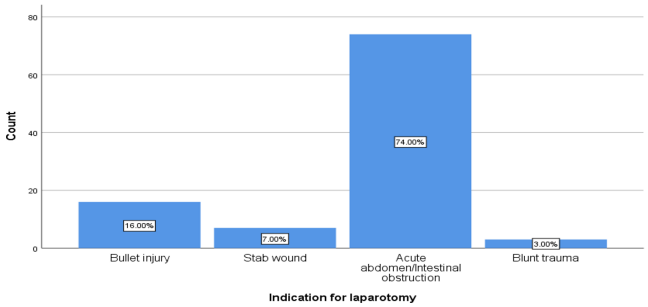

Figure 2. The indications for emergency laparotomy of 100 patients.

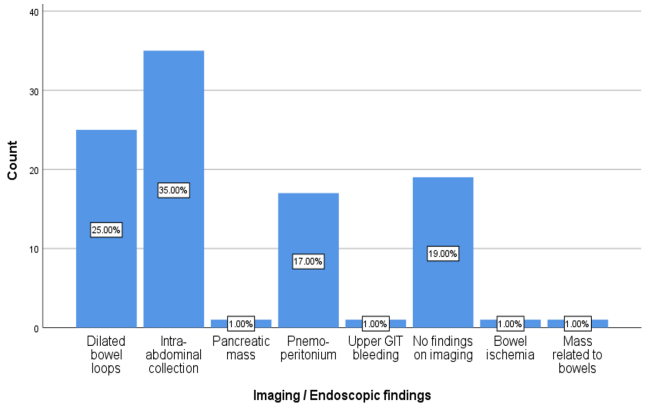

Figure 3. The imaging and endoscopic findings before surgery of 100 patients.

Table 1. The causes for the emergency laparotomy of 100 patients.

Diagnoses	Frequency	Percent
Perforated gastric or duodenal ulcer	19	19.0
Intestinal obstruction	18	18.0
Perforated appendix/Large bowel	13	13.0
Bowel injury	12	12.0
Strangulated hernia	4	4.0
Biliary injuries, obstructive jaundice, and gall bladder perforation	4	4.0
Pancreatic/duodenal injury	4	4.0
Bowel ischemia	4	4.0
Penetrating abdominal trauma	3	3.0
Splenic injury	3	3.0
Mesenteric injury	3	3.0
Ruptured hydatid cyst	3	3.0
Gynecological intra-peritoneal sepsis	3	3.0
Liver/Intra-abdominal vascular injury	2	2.0
Negative laparotomy	2	2.0
Anastomotic leakage	1	1.0
Intra-peritoneal urinary bladder injury	1	1.0
Upper GIT bleeding	1	1.0

anastomotic leakage, the need for anticoagulation after surgery, and admission to the ICU, while mortality was not associated with other factors (Table 3).

DISCUSSION

Emergency laparotomy is associated with high rates of postoperative complications, mortality, and prolonged hospital stays. There are high rates of differences among patient factors, underlying pathology, and surgical procedures. Compared with other surgical emergencies, patients who undergo emergency laparotomies have higher rates of mortality in young and fit patients as well as older and sicker patients. The mean age of our patients was 39.26 years, and this is a relatively young age because we include patients with trauma in this study. Advanced ages are associated with higher rates of both morbidity and mortality, according to most worldwide studies [9–11].

In our study, the commonest cause for emergency laparotomies included non-trauma cases (acute abdomen cases and intestinal obstruction in 74%), while trauma cases constituted the rest of the patients. During emergency laparotomy, the commonest finding was perforated gastric or duodenal ulcers in 19%, followed by intestinal obstruction in 18%, perforated appendix or large bowel in 13%, and bowel injuries in 12%, followed by other different findings in order of decreasing frequencies. A study that was reported in 2015 showed that the commonest cause of emergency laparotomy was perforated viscous [12].

In our study, the morbidity included wound infection (65%), anastomotic leakage (12%), bleeding (4%), deep venous thrombosis (2%), pulmonary embolism (10%), and burst abdomen (6%). Morbidity was reported in 69 patients. There was a significant association between the morbidity and the age of the patient (P-value = 0.045), the weight of the patients (P-value = 0.03), associated comorbidities (P-value = 0.004), the duration of operation (P-value = 0.011), the performance of bowel anastomosis during surgery (P-value = 0.002), and the admission to the ICU (P-value = 0.033). While the association was not significant with other factors such as sex, smoking status, steroid intake, hemoglobin level, the type of the incision, and the indication of emergency laparotomy, whether trauma or non-trauma cases. Older patients have been found to have a significant postoperative complications when compared to younger age groups; this is possibly attributed to associated comorbidities and the derangement of most of the physiological functions of the body due to the aging process. Similarly, obese patients have higher rates of associated medical conditions and respiratory complications [13–15].

Anastomotic leakage after surgery manifests itself as signs of peritonitis, tachycardia, hypotension, derangement of renal function, and coagulopathy. This condition was found to be significantly associated with both ICU admission and mortality in the present study (P-value = 0.017). The risk of anastomotic leakage after surgery is more evident between the 5^{th} and the 10^{th} days after surgery, follow-up is recommended to detect this complication at an early stage and prevent its disastrous outcomes [16].

Re-laparotomy was done in 11% of our patients, commonly due to leakage or bleeding. Re-laparotomy can be performed on demand when there is deterioration of the condition and the development of signs of peritonitis, other intra-abdominal catastrophes, or a planned one, which is done in cases of the development of some complications like adhesions or intestinal obstruction [17].

In the current study, mortality was reported in 9% of patients, and there was a significant association between mortality and the need for anticoagulation after surgery (P-value

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Table 2. The association between morbidity and different patient factors.

Category	Subcategories	Odds ratio	Morbidity		Sig.(2-sided)
			Yes (n = 69)	No (n = 31)	
Age		1.5	42.78 ± 20.192	31.42(SD:15.607)	0.045*
Sex	Male	0.6	44 (63.8%)	23 (74.2%)	0.305**
	Female		25 (36.2%)	8 (25.8%)	
Weight (Kg)		1.9	78.77 ± 18.122	70.29 ± 18.891	0.03*
Smoking	Smoker	0.43	31 (44.9%)	17 (54.8%)	0.359**
	Non-smoker		38 (55.1%)	14 (45.2%)	
Steroid intake	Yes	0.95	3 (4.3%)	0 (0.0%)	0.550***
	No		66 (95.7%)	31 (100.0%)	
Comorbidities	Yes	1.2	35 (53.0%)	26 (83.9%)	0.004**
	No		31 (47.0%)	5 (16.1%)	
Hemoglobin		3.36	11.61 ± 2.34	12.635 ± 2.337	0.191*
Duration of operation in minutes		1.76	116.01 ± 82.67	70.48 ± 33.075	0.011*
Abdominal pain	Yes	0.98	68 (98.6%)	31 (100.0%)	1.00***
	No		1 (1.4%)	0 (0.0%)	
Nausea and vomiting	Yes	0.36	49 (71.0%)	27 (87.1%)	0.082**
	No		20 (29.0%)	4 (12.9%)	
Incision type	Midline incision Upper	1.21	56 (81.2%)	23 (74.2%)	0.148***
	midline incision Lower		5 (7.2%)	5 (16.1%)	
	midline incision		6 (8.7%)	1 (3.2%)	
	Transverse supra-pubic incision		0 (0.0%)	1 (3.2%)	
	Para-median incision		2 (2.9%)	0 (0.0%)	
	Right subcostal incision		0 (0.0%)	1 (3.2%)	
Bowel anastomosis	Yes	5	31 (44.9%)	4 (12.9%)	0.002**
	No		38 (55.1%)	27 (87.1%)	
Admission to ICU	Yes	2.79	31 (44.9%)	7 (22.6%)	0.033**
	No		38 (55.1%)	24 (77.4%)	
Trauma case	Trauma case	1.5	21 (30.4%)	7 (22.6%)	0.419**
	Non-trauma case		48 (69.6%)	24 (77.4%)	

* Independent t-test; **Pearson chi square test; ***Fischer's exact test.

= 0.000) and admission to the ICU (P-value = 0.002). While the mortality was not associated with other factors. Previous studies that were reported for emergency laparotomies showed that the mortality rate ranged from 5.2 to 9% of the cases. Mortality is found in most studies to be associated with higher age and associated comorbidities [18, 19].

The World Health Organization (WHO) Surgical Safety Checklist has fostered safe practice for 10 years, and its application is associated with improved postoperative outcomes in the settings of both elective and emergency surgeries [20].

The rate of ICU admission among our patients was relatively high (38%), and it was significantly associated with both morbidity and mortality after surgery. Previous studies reported a higher rate of admission in the advanced age patients, those with very high inflammatory markers, and a high ASA (American Society of Anesthesiologists) class. In addition, sepsis is among the most common causes of the need for ICU admission after emergency laparotomies [21–24].

Emergency laparotomy is a common surgical procedure in surgical practice. We concentrated in this study on various factors that commonly affected the outcome of surgery; however, more studies are required that include a larger number of patients and in various centers all over Iraq to standardize the management of patients, reduce ICU admissions, and improve the outcome after surgery.

The limitations of the study are the relatively small sample size, single center, and relatively short duration of follow-up. A larger sample size and longer duration of follow-up may diagnose some long term complications, such as incisional hernias, and sub-acute and acute intestinal obstruction from a variety of causes, and other long term complications. Owing to above-mentioned limitations, the results of the study cannot be generalized.

CONCLUSION

The study revealed that the incidence of morbidity and mortality following an emergency laparotomy was high. Patient age, body weight, associated comorbidities, prolongation of the operative time, performance of bowel anastomosis, and admission to the ICU were risk factors for morbidity. Higher fatality rates were due to anastomotic leakage, the requirement of anticoagulation, and admission to the ICU.

ETHICAL DECLARATIONS

Acknoweldgements

None.

Table 3. The association between mortality and different patients factors.

Category	Subcategories	Odds ratio	Morbidity		Sig.(2-sided)
			Yes (n = 9)	No (n = 91)	
Age			63.33 ± 14.018	36.88 ± 18.406	0.267*
Sex	Male Female	1.8	7 (77.8%) 2 (22.2%)	60 (65.9%) 31 (34.1%)	0.714***
Weight (Kg)		1.25	91.89 ± 11.868	74.58 ± 18.558	0.217*
Smoking	Smoker Non-smoker	2.33	6 (66.7%) 3 (33.3%)	42 (46.2%) 49 (53.8%)	0.305***
Steroid intake	Yes No	1.03	0 (0.0%) 66 (95.7%)	3 (3.3%) 31 (100.0%)	1.00***
Comorbidities	Yes No	0.256	3 (33.3%) 6 (66.7%)	58 (65.9%) 30 (34.1%)	0.073***
Hemoglobin		0.688	11.911 ± 2.0787	11.93 ± 2.41	0.545*
operation in minutes		2.13	146.67 ± 74.162	97.47 ± 72.883	0.881*
Bowel anastomosis	Yes No	4.27	6 (66.7%) 3 (33.3%)	29 (31.9%) 62 (68.1%)	0.062***
Pulmonary embolism	Yes No	2.96	2 (22.2%) 7 (77.8%)	8 (8.8%) 83 (91.2%)	0.221***
Wound infection	Yes No	0.64	5 (55.6%) 4 (44.4%)	60 (65.9%) 31 (34.1%)	0.716***
Bleeding	Yes No	3.66	1 (11.1%) 8 (88.9%)	3 (3.3%) 88 (96.7%)	0.318***
DVT	Yes No	11.25	1 (11.1%) 8 (88.9%)	1 (1.1%) 90 (98.9%)	0.173***
Anastomotic leak	Yes No		3 (33.3%) 5 (55.6%)	9 (9.9%) 81 (89.0%)	0.017***
Re-laparotomy	Yes No	2.6	2 (22.2%) 7 (77.8%)	9 (9.9%) 82 (90.1%)	0.257***
Need for anticoagulants	Yes No	23.65	8 (88.9%) 1(11.1%)	23 (25.3%) 68 (74.7%)	0.000***
Admission to ICU	Yes No	16.36	8 (88.9%) 1 (11.1%)	30 (33.0%) 61 (67.0%)	0.002***
Trauma case	Trauma case Non-trauma case	0.262	21 (30.4%) 48 (69.6%)	7 (22.6%) 24 (77.4%)	0.478**

* Independent *t*-test; **Pearson chi square test; ***Fischer's exact test.

Ethics Approval and Consent to Participate

Ethical approval is granted from the Kurdistan Board for Medical Specializations at 2/1/2021 with a reference number of 29180968. Informed consent was obtained from the participants.

Consent for Publication

Not applicable (no individual personal data included).

Availability of Data and Material

Data generated during this study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that there is no conflict of interest.

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Authors' Contributions

All stated authors contributed significantly, directly, and intellectually to the work and consented it to be published.

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