Factors affecting mortality in emergency colectomy for ischemic colitis

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The purpose of this study was to determine the factors that influence postoperative mortality after emergency colectomy for ischemic colitis.

Methods:

From January 2017 to January 2020, we studied the data of patients who had emergency open colectomy at Minia University Hospital and Ain Shams University Hospital. Clinical and surgical indicators linked to postoperative morbidity, mortality, hospital stay, ICU stay, and survival were investigated using logistic regression analysis.

Results:

94 patients with ischemic colitis (mean age: 67.4 ± 13.7 years) had emergency open colectomy in this study. The mean duration of the ICU stay and hospital stay were 67 ± 71.2 and 19 ± 19 days respectively. High preoperative lactate levels, a delay of more than 12 hours between the beginning of clinical manifestations and surgery, and the development of postoperative acute renal injury were all statistically linked to increased postoperative mortality. Mortality rate after restoration of intestinal continuity was 8.5%.

Conclusion:

A high rate of postoperative death is related with emergency open colectomy for ischemic colitis. Lactate levels before surgery, longer duration more than 12 hours wait for surgery, and postoperative acute renal injury were all found to be risk factors of postoperative death.

Keywords:
Emergency, colon, surgery, predictors

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Introduction

Ischemic colitis is a major abdominal surgery emergency[1] with a 50–80% fatality rate [2, 3]. It is the most common type of intestinal ischemia, with a frequency of 15.6–17.7/100,000 person-years [4]. Patients with coronary artery disease, arterial hypertension, atrial fibrillation, peripheral vascular disease, diabetes mellitus, chronic renal diseases, and hemodialysis were found to be at higher risk for development of ischemic colitis [5–6]. Age greater than 50 years [5], hemodynamic instability [5], right colon involvement alone [7, 8], hypertension, and chronic renal diseases are all poor prognostic markers for ischemic colitis-related death. [7,8]

Ischemic colitis is caused by two types of disorders: occlusive and nonocclusive disorders [4]. In either situation, the ischemic injury is caused by a lack of blood supply to the colon, resulting in a variety of ischemic injuries ranging from superficial mucosal lesions to full-thickness transmural necrosis [9]. Depending on the severity of the condition, the clinical manifestations may include diarrhoea, abdominal pain, lower gastrointestinal haemorrhage, and a continuing fever [4, 10, 11].

Patients with ischemic colitis who need surgery are often treated in an emergency room, which has a higher rate of postoperative death than elective surgery [12, 13].

Methods

Between January 2017 and January 2020, patients who underwent emergency colonic surgery for ischemic colitis at Minia University Hospital and Ain Shams University Hospital (Egypt) were included in this study. The study was approved by both Minia and Ain Shams Faculty of Medicine's ethical council, and all patients were given written consent after a thorough explanation of the operation and its risks.

Preoperative diagnostic includes a computed CT scan, colonoscopy, and surgical specimen histology. Signs such as colonic wall weakening, or colonic wall thickening, or aberrant wall enhancement were taken into account. Signs of porto-mesenteric venous gas or pneumatosis, intraperitoneal air, or mesenteric arterial or venous thrombosis may also be present. A colonoscopy was performed on all of the patients..

Demographics, comorbidities, etiologies, and geographic location were all investigated. We calculated the Reissfelder *et al* Ischemic's Colitis Mortality Risk (ICMR) score (17). Variables during and after surgery were also investigated. In an emergency colonic operation, the degree of resection varies depending on the degree of ischemia, preoperative and intraoperative findings, and can range from segmental to complete colonic resection.

During an exploratory laparotomy, all thickened, dead, or edematous colonic segments were removed. After that, the colon was transected at a healthy spot determined by the operative surgeon. For left colon lesions, a Hartmann's operation or left colectomy was performed, which included rectosigmoid junction excision. Right colectomy with excision of the right flexure and double-barreled ileo-colostomy were performed on the right colon. Ischemic colitis affecting the right colon up to the splenic flexure necessitated a subtotal colectomy. Total colonic ischemia was treated by a pancolectomy and a terminal ileostomy.

Following surgery, all of the patients were admitted to the intensive care unit. Postoperative morbidity, length of hospital stay, and ICU stay were all factors were considered. The acute kidney injury was discovered by a nephrologist. Isolated troponin elevation, ECHO abnormalities, and/or clinical signs of heart attack were all indicators of myocardial infarction. Respiratory complications included postoperative pneumonia or the need for intubation (for more than 48 hours). As regard the intestinal continuity restoration, all patients were followed up for one year.

Statistical analysis

The statistical analysis was carried out using Statistical Package for Social Science software version 23. Depending on the situation, quantitative data were presented by mean and standard deviation if data were normally distributed or median and range if data were not normally distributed, while qualitative data were presented by frequency distribution. Fisher exact test, or chi-square test were used to compare proportions. The Student t test and Mann–Whitney U test were used for continuous variables. Multiple regression analysis was used to determine the combined effect of clinical and surgical features on postoperative mortality. With a 95% confidence interval, the odds ratios (OR) and adjusted odds ratios (AOR) were displayed (CI). A p value of less than 0.05 was considered statistically significant.

Results

During the study, 94 patients with ischemic colitis underwent emergency open colectomy. The study participants' average age was 67.4 (SD=13.7) years, with 64.8 percent of them being female. In the majority of cases (53.2 percent), ischemic colitis affected the whole colon, necessitating pancolectomy with terminal ileostomy. The time elapsed between the onset of manifestations and the surgery was more than 12 hour in 74.4 percent of patients.

Trauma caused 9 cases, arterial emboli caused 6 cases, radiation caused 8 cases, thrombosis emboli caused 4 cases, colon cancer caused 19 cases, cocaine abuse caused 1 case, Clostridium difficile caused 2 cases, inflammatory bowel disease caused 20 cases, 5 cases were caused by nonsteroidal anti-inflammatory medications, 5 cases were caused by volvulus, 1 case was caused by hemodialysis, and 14 cases were caused by hypo-perfusion. The follow-up period ranged from 9–30 months (median =16 months).

Table 2 shows operative and postoperative characteristics of the studied patients, within 90 days following their surgery, 66 patients (70.2 percent) died. The mean duration of the ICU stay and hospital stay were 67 ± 71.2 and 19 ± 19 days respectively.

Lactate levels greater than 2.5 mmol/L, time from commencement of signs/symptoms to surgery greater than 12 hours, sepsis, and blood loss greater than 500 mL were all found to be significantly related with postoperative death in the univariate analysis (Table 3). In the multivariate model, time from onset of manifestations to operation, preoperative lactate levels, and postoperative acute renal injury all statistically related to postoperative death.

Discussion

The present study revealed that the high rate of postoperative mortality was attributed to high preoperative lactate levels, delayed intervention from manifestations to operation (> 12 hours), and the presence of postoperative acute renal injury among patients required an emergency colonic surgery.

Table 1 Clinical and laboratory characteristics of patients undergoing emergent open colectomy (n = 94)

Variables	No. (%)
Sex (Female/Male) [n]	61/33
Age, years [mean (SD)]	67.44 (13.70)
Age more than 75 years [n (%)]	33 (36.2)
Body mass index (kg/m2) [mean (SD)]	24.25 (4.98)
Body mass index more than 30 (kg/m2) [n (%)]	12 (11.7)
Preoperative white blood cell count [mean (SD)]	15.51 (9.69)
Preoperative haemoglobin (g/dL) [mean (SD)]	9.33 (2.71)
Preoperative creatinine (mg/dL) [mean (SD)]	194.55 (142.09)
Preoperative lactates (mg/dL) [mean (SD)]	5.3 (4.31)
Preoperative pH [mean (SD)]	7.24 (0.15)
Prothrombin ratio [mean (SD)]	76 (15.36)
Diabetes mellitus [n (%)]	15 (17)
Severe coronary artery disease [n (%)]	72 (74.5)
History of transient ischemic attacks [n (%)]	9 (8.5)
HTN [n (%)]	62 (70.2)
Chronic obstructive pulmonary disease [n (%)]	21 (21.3)
Smoking [n (%)]	29 (31.9)
Renal failure [n (%)]	23 (25.5)
Time elapsed from manifestations onset to surgery [n (%)]	
< = 12 h	24 (25.6)
> 12 h	70 (74.4)
Site of ischemia [n (%)]	
Lt sided colon	20 (21.3)
Rt sided colon	3 (3.2)
Transverse colon	7 (7.4)
Right and transverse colon	14 (14.9)
Whole colon	50 (53.2)
Colonic perforation [n (%)]	
Colonic resection type[n (%)]	19 (20.2)
Hartman's procedure	20 (21.2)
Subtotal colectomy with ileo-sigmoid colostomy	20 (21.2)
Pancolectomy with terminal ileostomy	50 (53.1)
Right colectomy with ileo-colonostomy	4 (4.2)

HTN: Hypertension

Table 2 Operative and postoperative characteristics of the studied patients

Variables	
Length of operative time, min [mean (SD)]	151.53 (55.33)
Blood loss volume, mL [median (range)]	455 (100–890)
Patients need blood transfusion [n (%)]	51 (53.2)
MOF [n (%)]	55 (59.6)
ATN [n (%)]	50 (54.3)
Hepatic failure [n (%)]	4 (5.3)
Heart attack [n (%)]	9 (8.5)
Respiratory failure [n (%)]	17 (18)
Low urine output syndrome [n (%)]	5 (5.2)
Sepsis [n (%)]	39 (40.7)
ICU admission [n (%)]	93 (99)
Length of ICU stay, days [mean (SD)]	19 (19)
Reoperation [n (%)]	15 (16.1)
Length of hospital stay, days [mean (SD)]	22 (22)
Postoperative death at 90 days [n (%)]	66 (70.2)
One year survival [n (%)]	28 (29.7)
Restoration of intestinal continuity at 1 year after surgery [n (%)]	13 (47.1)
Mortality after restoration of intestinal continuity at 1 year after surgery [n (%)]	0
Survival status (one year postoperative)	
Alive	20 (73.9)
Dead for ischemic colitis related causes	4 (11.3)
Dead from any other cause	4 (11.3)

MOF: multi-organ failure; ATN: acute tubular necrosis; ARDs: acute respiratory distress syndrome

Chung *et al*. (2010) established a predictive model based on three preoperative variables: tachycardia, shock within 24 hours of admission, and colonoscopic evidence of ulceration, which could identify severe ischemic colitis necessitating surgery or being life-threatening. The probability of severe ischemic colitis was one percent if none of these three variables were present, and 74 percent if all three were present[14] [Table 1.

The validity of the ICMR score was investigated by Castleberry *et al*. in 2013 by using a 10-year cohort analysis of 115 patients who had colectomy for acute ischemic colitis. Individual components of the ICMR score with preoperative lactate levels more than 2.5 mmol/L, postoperative renal damage necessitating hemodialysis and the use of intraoperative vasopressor agents were all predictors of increased inhospital mortality rate. On the other hand, whether the non-occlusive cause of ischemic colitis or the need for total or subtotal colectomy were not substantially associated with high inhospital mortality rate [15].

In agreement with the previous study, the current study confirmed on the ultimate significance of the preoperative lactate level, postoperative acute renal injury as predictors for high mortality rate. We have discovered that the time between diagnosis and surgery has a significant impact on mortality risk, with those who were operated on after > 12 hours from the onset of signs/symptoms being at higher risk than those who received an early diagnosis and surgical treatment. Severe cases were more likely to be rushed to the operating room, but they were also linked to a poor prognosis because of the severity and extent of the ischemic lesion [4, 5, 6, 16, 12, 17, 18, 19].

The kind of surgical procedure performed, such as segmental resection or total colectomy, the surgical environment, and the patient's overall health, such as the presence of comorbidities or hemodynamic stability, all influence the prognosis and mortality. Some researchers prefer to take a more aggressive approach, doing left or subtotal colonic resections rather than a segmental resection like right colectomy [3, 9, 20]. Paterno *et al*.[6] reported that a segmental colonic resection is sufficient without increased

Table 3 Factors related to postoperative death

Variables	Univariate analysis		Multivariate analysis		p value
	In-hospital postoperative Mortality	Odds ratio (95%CI)	p value	Adjusted odds ratio (95%CI)	
Age > 75 years [n (%)]	26 (78.4)	2.22 (0.83–5.96)	0.162		
Age > 80 years [n (%)]	15 (78.8)	1.72 (0.51–5.75)	0.572		
Age, years	NA	1.01 (0.99–1.06)	0.097	1.02 (0.98–1.09)	0.156
Female [n (%)]	45 (72)	1.26 (0.52–3.19)	0.642		
ASA score > III [n (%)]	22 (88.8)	2.30 (0.77–6.85)	0.213		
Pancolic ischemia [n (%)]	34 (69)	1.09 (0.45–2.61)	1		
Obesity [n (%)]	8 (73.6)	2.32 (0.35–5.92)	0.833		
BMI (per unit increase)	NA	1.02 (0.92–1.13)	0.695		
Decrease albumin level (less than 3.5 g/dL) [n (%)]	4 (81)	1.84 (0.20–17.19)	1		
Lactates more than2.5 mmol/L [n (%)]	55 (76.6)	4.38 (1.58–12.17)	0.007	11.83 (1.63–85.16)	0.013
Preoperative hemoglobin level	NA	1 (0.82–1.21)	0.974		
Diabetes [n (%)]	56 (71.9)	1.99 (0.66–5.98)	0.245		
Severe coronary disease [n (%)]	51 (71.5)	1.6 (0.57–3.98)	0.450		
COPD [n (%)]	49 (66.5)	1.43 (0.46–4.53)	0.595		
Kidney failure [n (%)]	48 (68.1)	1.48 (0.51–4.36)	0.612		
Hypertension [n (%)]	16 (59.7)	1.71 (0.67–4.37)	0.328		
Smoking [n (%)]	42 (66.2)	1.34 (0.50–3.56)	0.635		
Comorbidity > 1 [n (%)]	32 (78.5)	2.28 (0.90–5.78)	0.115	1.80 (0.34–9.8)	0.491
Time from manifestations Onset to surgery> 12 h [n (%)]	61 (85.5)	9.73 (7.02–73.97)	<0.0001	37.99 (7.20–171.43)	<0.0001
Total colectomy [n (%)]	34 (60)	1.07 (0.35–2.51)	1		
Sepsis [n (%)]	33 (85.2)	4.71 (2.33–11.32)	0.013	3.31 (0.61–9.79)	0.208
Postoperative acute kidney Injury [n (%)]	40 (78.5)	3.12 (0.87–7.17)	0.120	6.09 (2.13–22.8)	0.043
Operative time, min	NA		1 (0.98–1.02)	0.494	
Blood loss > 500 mL [n (%)]	45 (78.9)	3.20 (1.38–7.99)	0.015	2.50 (0.70–9.1)	0.179

COPD for chronic obstructive pulmonary disease

mortality in the case of limited ischemic colitis with stable hemodynamics.

In the current study, the lesion affected the entire colon in 53.2 percent of cases, and the majority of surgeries were subtotal or total colectomies. When an emergency colectomy is required, however, death appears to be unrelated to the cause. Colectomy survivors also revealed a restoration of intestinal integrity in nearly half of the cases, with no postoperative mortality.

Castleberry *et al.*[15] found that 24% of ischemic colitis survivors underwent elective end-ostomy reversal, with an 18% death rate. Others were unable to identify any clinical or biological factors that could be used to help in differentiating which patients should have reversal surgery. They considered that restoring intestinal continuity should be discussed at a multidisciplinary meeting for every surviving ischemic colitis patient to improve their quality of life [21]. Further researches may support the prospect of treating ischemic colitis by emergency laparoscopy in order to benefit from the minimally invasive approach's shorter postoperative period [22, 23].

Conclusions

Postoperative mortality is significantly high after emergency open colonic surgery for ischemic colitis. Preoperative lactate levels, delay in operation for more than 12 hours, and the occurrence of postoperative acute renal injury were all determinants of the postoperative mortality rate. Colonic surgery's aetiology appears to have no influence on postoperative mortality.

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Author contributions

All authors contributed to the study conception and design. Material preparation and data collection were performed by Dr Emad. The analysis and first draft of the manuscript was written by D Amr Abdel Hameed and all authors commented on previous

versions of the manuscript. All authors read and approved the final manuscript

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Conflicts of interest
There are no conflicts of interest.

Ethics approval
The title, aim, and plan of the study were discussed and approved regarding ethics of research in the General Surgical Department, Minia Faculty of Medicine.

Consent to participate
Full written and informed consent was obtained from all relevant participant.

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