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ORIGINAL ARTICLE

The length of necrosis and renal insufficiency predict the outcome of acute mesenteric ischemia

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KEYWORDS
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Summary *Background:* Acute mesenteric ischemia (AMI) is a potentially life-threatening condition because of its diagnostic difficulty, operative challenges, and comorbidities a patient may have. The aim of this study was to identify factors associated with adverse outcomes in patients with AMI.
Methods: The hospital records and clinical data of all patients with AMI were reviewed for a recent 4-year period. Clinical outcomes and factors influencing mortality were analyzed.
Results: Included in the study were 104 patients (46 females and 58 males) with an overall mean age of 66 ± 13.4 years. The cause of AMI was arterial pathology in 74 (71%) patients, venous thrombosis in 15 (14%) patients, and nonocclusive ischemia in 12 (12%) patients. Abdominal pain was the most common presenting symptom (97% of patients). The 30-day mortality rate was 66%. Univariate analysis showed that mortality was associated with renal insufficiency ($p = 0.004$), an age greater than 70 years ($p = 0.02$), the presence of comorbidities ($p = 0.001$), a leukocyte count greater than 18,000/mL ($p = 0.04$), and small bowel necrosis of more than 100 cm ($p < 0.0001$). Logistic regression analysis showed that independent predictors of mortality were small bowel necrosis of more than 100 cm ($p = 0.002$) and a serum creatinine level greater than 2 mg/dL ($p = 0.04$).
Conclusion: The length of the necrosis and renal insufficiency are the primary factors that result in a poor outcome in AMI patients. Prompt diagnostic evaluation and early therapeutic interventions may help to prevent the development of these fatal predictors.

Conflicts of interest: Each author certifies that they have no financial and personal relationships with other people or organizations that could inappropriately influence their work.

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1. Introduction

Acute mesenteric ischemia (AMI) is an uncommon surgical emergency and is often diagnosed at a late stage. It is associated with a mortality rate of 60—80%, which has remained unchanged for the past few decades. These poor outcomes are primarily because of the difficulty of early diagnosis and the rapid nature of the ischemic tissue deterioration.[1]

Acute mesenteric ischemia can be classified primarily as ischemia of thrombotic origin or ischemia of non-thrombotic origin. Nonocclusive mesenteric ischemia results from low-flow states, whereas thrombotic conditions include arterial embolism, arterial thrombosis, and mesenteric venous thrombosis.[2] Early diagnosis, resection of the infarcted bowel, restoration of blood flow, second-look laparotomy, and supportive intensive care are the basis of adequate management; however, the existing literature for the most part focuses on a relatively small number of patients.[3]

Despite the dismal prognosis, accurate presurgical and perioperative assessment of the risk of death in patients with AMI is poorly defined. Knowledge of preoperative and perioperative risk factors and estimating mortality would aid physicians, patients, and patients' families in decision-making and treatment planning. For this reason, researchers have sought to identify factors that may indicate an ominous prognosis and justify aggressive initial intervention for this condition.[3—5] In the literature, there are unfortunately scant data evaluating these factors. The objective of this study was to determine clinical variables that could have an impact on the perioperative mortality of AMI.

2. Methods

The hospital charts and clinical records of all patients who underwent surgical intervention for AMI at Erciyes University Medical Faculty (Kayseri, Turkey) were evaluated with regard to demographic information, presenting symptoms, comorbid medical conditions, history and physical examination findings, laboratory and radiographic examinations, surgical procedure, hospital stay, and treatment outcome. The records of the radiologic examinations were abstracted and findings suggestive of bowel ischemia such as bowel wall thickening, ileus, pneumatosis intestinalis, or an occlusion in the superior mesenteric artery (SMA) or superior mesenteric vein (SMV) were classified as positive radiological findings. The time delay from the onset of the symptoms to surgery was also evaluated, and was categorized as less than 1 day or more than 1 day. Based on clinical, radiological, surgical, and histopathological findings, patients were diagnosed as having a mesenteric embolus, arterial or venous thrombosis, nonocclusive mesenteric ischemia, or an undetermined etiology. Operative findings with regard to small bowel necrosis were first divided into two groups: (1) patients with small bowel necrosis and (2) patients without small bowel necrosis. They were further divided into four groups: (1) patients without any necrosis; (2) patients with total necrosis; (3) patients with small bowel necrosis of more than 100 cm; and (4) patients with necrosis of less than 100 cm. For statistical analysis, patients with total necrosis were added to patients with small bowel necrosis more of than 100 cm. Patients with total intestinal necrosis underwent exploration alone because it was believed to be incompatible with survival.[6,7] The decision to perform a second-look operation was based on clinical findings of marginally viable bowel during the initial operation. The factors associated with survival were analyzed. Mortality was defined as mortality 30 days after the surgical procedure.

For statistical analysis, the associations between mortality rate and risk factors were assessed univariately with a two-sample t test, the Wilcoxon rank sum test, and the χ^2 test or Fisher's exact test. A multivariate logistic regression analysis model using JMP software (SAS, Cary, NC) was constructed with factors that were significantly associated with survival rate, based on univariate analysis results. Data are expressed as the mean $\pm$ the standard error of the mean. The test results were considered significant at $p < 0.05$.

3. Results

From January 2008 to December 2011, 104 patients underwent surgical interventions for AMI at Erciyes University (Kayseri, Turkey). There were 58 men and 46 women (mean age, 66 $\pm$ 13.4 years; age range, 32—83 years). Sixty-nine patients died as a result of AMI during the perioperative period. Of the 69 deceased patients, 23 patients had total small bowel necrosis and no surgical procedure was performed. They died during the first 3—96 hours. In addition, 25 patients had widespread intestinal necrosis and only three of these patients survived. The cause of AMI was arterial pathology in 74 (71%) patients, venous thrombosis in 15 (14%) patients, and nonocclusive mesenteric ischemia in 12 (12%) patients. In three patients, we were unable to determine the exact cause. They were observed to have shock with worsening acidosis and were taken immediately to the operating room for exploration. Acute abdominal pain was the most frequent symptom [97 (93%) patients], followed by nausea. Most patients (73 patients) had acute abdominal pain for a median time of more than 24 hours. Plain abdominal radiography was performed in 96 (92%) patients, abdominal computed tomography (CT) scan in 87 (84%) patients, mesenteric Doppler ultrasound in 5 (5%) patients, and mesenteric angiography in 2 (2%) patients. The time delay from the onset of symptoms to surgery was less than 1 day in 27 (26%) patients and more than 1 day in 77 (74%) patients. All patients underwent an operation. Twenty-six patients underwent a second-look operation; among these patients, 21 patients had additional bowel necrosis that necessitated an additional intestinal resection in 19 of them, but no further resection was necessary in the remaining two patients because of total bowel necrosis. A vascular mesenteric procedure (i.e., mesenteric embolectomy in all patients) was performed in only eight (8%) patients. Univariate analysis revealed that mortality was significantly associated with an age of greater than 70 years, a leukocyte count greater than 18000/dL, a creatinine level greater than 2 mg/dL, the presence of at