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ORIGINAL ARTICLE

Evaluation of prognosis and factors influencing the need for second look in patients with acute mesenteric ischemia

Rozan KAYA[1]
Abdulhakim İbrahim ULUSOY[2]
Ufuk Oguz IDİZ[3]

1. İstanbul Eğitim ve Araştırma Hastanesi
2. Avcılar Murat Kölük Devlet Hastanesi
3. İstanbul Eğitim ve Araştırma Hastanesi

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Corresponding Author: Rozan Kaya, ORCID ID: 0000-0002-5136-5873

Istanbul Training and Research Hospital, Department of General Surgery, Istanbul, Turkey

E-mail: rozankaya@hotmail.com

Abstract

Introduction: Acute mesenteric ischemia(AMI), a condition associated with high mortality risk and challenging diagnosis, typically arises due to arterial blockages in mesenteric vessels. Despite the absence of a specific diagnostic test for this condition, various markers are utilized in its diagnosis. In our study, we aimed to assess the clinical and laboratory results of patients requiring surgical intervention due to AMI.

Materials and Methods: Our study included 25 patients diagnosed with AMI between January 2017-January 2019. Demographic characteristics, comorbidities, time of hospital admission, blood parameters (leukocyte count, platelet count, amylase, lactate, arterial blood pH, bicarbonate, actate dehydrogenase), preoperative abdominal computed tomography results, duration of surgery, clinical course, need for secondary surgery within 48 hours postoperatively, additional resection requirement, and postoperative clinical follow-ups were recorded from hospital records.

Results: The mean age of patients was 70.2±12.7 years, with a male-to-female ratio of 14/11. Eighteen patients(72%) were identified to have occlusion in the superior mesenteric artery due to thrombosis or embolism. In seven of these patients(68%), secondary surgery was required within 48 hours postoperatively, with an additional resection needed in 12 cases. The group with a fatal outcome exhibited significantly higher lactate values compared to the surviving group. Among survivors, there was a trend indicating a shorter time from emergency room admission to surgery, but no statistically significant difference was observed. In patients requiring secondary surgery, leukocyte values post the initial surgery were observed to be higher, although not significantly, compared to those not requiring additional resection.

Conclusion: In elderly individuals with accompanying illnesses presenting to the emergency room with abdominal pain, the possibility of AMI should be considered. Elevated leukocyte and lactate levels may support the clinician's suspicion of AMI. Additionally, high leukocyte values in the postoperative period could serve as an indicator that ischemia may have progressed, necessitating secondary intervention.

Keywords: Mesenteric ischemia, leukocyte, second look, lactate

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Introduction

Acute mesenteric ischemia (AMI) is a critical emergency condition with a high risk of mortality and morbidity due to intestinal ischemia and infarction. Mortality rates can be as high as 65%, with delays in diagnosis and treatment being significant contributors to this outcome [1-3].

The main causes of mesenteric ischemia include mesenteric artery embolism (50% of cases), mesenteric artery thrombosis (15-25%), mesenteric venous thrombosis (5%), and non-occlusive mesenteric ischemia (20-30%) [4,5]. While open surgery is the primary treatment method, percutaneous transluminal angioplasty (PTA) and stenting are also utilized in endovascular treatment, offering faster blood flow and reducing the risk of mortality and morbidity [6-10].

Diagnosing mesenteric ischemia can be challenging, as severe abdominal pain may not always align with physical examination findings. Intravenous contrast-enhanced computed tomography (CT) is commonly preferred for diagnosis due to its high sensitivity and specificity, despite some guidelines recommending angiography as the gold standard [11,12,13,14].

Despite efforts, a specific biochemical marker for mesenteric ischemia diagnosis has not been established. While L-lactate, D-dimer levels, serum alpha-glutathione S-transferase, and nesfatin-1 have been reported to assist in diagnosis, a conclusive marker is yet to be determined [11,15].

The study aims to assess the impact of laboratory results and clinical findings on the diagnosis and prognosis of patients with acute mesenteric ischemia.

Materials and Methods

This retrospective study, conducted with ethical approval, involved reviewing the records of 1679 patients who presented to the emergency department with abdominal pain complaints and were referred to the General Surgery clinic between January 2017 and January 2019. Among them, 29 patients were diagnosed with acute mesenteric ischemia. Excluding four patients with incomplete information and those referred to different hospitals post-surgery, the study analyzed data from hospital records, including demographic details, comorbidities, admission time, blood parameters (leukocyte count, platelet count, amylase, lactate, pH, HCO3, and lactate dehydrogenase), surgery duration, secondary care needs at 48 hours postoperatively, additional resection requirements, and postoperative clinical follow-ups.

Patients were grouped based on postoperative survival and the need for additional resection during secondary surgery, with data comparisons between these subgroups. The study utilized the SPSS 20 program for variable analysis, assessing data distribution with the Kolmogorov-Smirnov test. Quantitative independent variables were analyzed using the independent sample t-test and Mann-Whitney U test, while the Wilcoxon test was applied for dependent quantitative variables. The Chi-square test was employed for qualitative independent variables analysis, and in cases where its conditions were not met, the Fisher’s exact test was preferred.

Results

The study included 25 patients with a male-to-female ratio of 14/11 and an average age of 70.2±12.7 years. Only one patient (4%) had no comorbidities. Thrombosis or embolism in the superior mesenteric artery (SMA) was the cause of AMI in 72% of cases. Among the 17 patients, 68% underwent secondary surgery after 48 hours, with 12 requiring additional resection due to progressing intestinal ischemia. Demographic and clinical data are summarized in Table 1.

In examining the impact of collected data on mortality, a significant difference in lactate values (p:0.043) was noted between the group with mortality and the group without (Table 2). Surviving patients generally underwent surgery within 12 hours of emergency room admission, though this difference was not statistically significant. No significant variations were observed in other variables.

When patients undergoing secondary care were categorized based on the need for additional resection, no significant differences were found among the examined parameters. However, patients requiring additional resection exhibited significantly higher postoperative leukocyte values and significantly lower platelet values after the initial surgery (Table 3).

Parameter		
Age (year) (Mean±SD)	70.20±13.05	
Time Between Applying to the Emergency Department and Surgery (n,%)	<12 hour	11 (%44)
	≥12 hour	14 (%56)
Preoperative leukocyte x10³ (Mean±SD)		17.02±8.51
Postoperative leukocyte x10³ (Mean±SD)		17.27±10.74
Platelet x10³ (Mean±SD)		239.04±133.72
Arterial pH (Mean±SD)		7.31±0.09
Amilase (U/L) (Mean±SD)		126.08±103.54
Lactate (mmol/L) (Mean±SD)		3.42±1.68
Bicarbonate (HCO3) (mEq/L) (Mean±SD)		20.46±3.33
Lactate Dehydrogenase (U/L) (Mean±SD)		367.60±143.15

Table 1: Distribution of demographic and laboratory data of all patients

Parameter		Survival (n:8)	Exitus (n:17)	P value
Age (year) (Mean±SD)		68.63±14.84	70.94±12.55	0.662
Gender (n,%)	Female	4 (%50)	10 (%58.8)	1.000
	Male	4 (%50)	7 (%41.2)	
Time Between Applying to the Emergency Department and Surgery (n,%)	<12 hour	6 (%75)	8 (%47.1)	0.189
	≥12 hour	2 (%25)	9 (%52.9)	
Second Look (n,%)	No	3 (%37.5)	5 (%29.4)	1.000
	Yes	5 (%62.5)	12 (%70.6)	
Preoperative leukocyte x10³ (Mean±SD)		17.66±10.83	16.72±7.56	0.804
Postoperative leukocyte x10³ (Mean±SD)		15.53±12.06	18.08±10.35	0.591
Platelet x10³ (Mean±SD)		270.25±132.09	224.35±135.91	0.435
Arterial pH (Mean±SD)		7.35±0.09	7.29±0.08	0.152
Amilase (U/L) (Mean±SD)		148.38±126.36	115.59±93.43	0.727
Lactate (mmol/L) (Mean±SD)		2.46±1.41	3.88±1.63	0.043
Bicarbonate (HCO3) (mEq/L) (Mean±SD)		21.67±4.36	19.90±2.70	0.221
Lactate Dehydrogenase (U/L) (Mean±SD)		337.50±118.99	381.76±154.52	0.483

Table 2: Comparison of demographic and clinical data of patients who survived and those who died in the postoperative period

Parameter		No additional resection (n:5)	Additional resection required (n:12)	P value
Age (year) (Mean±SD)		71.60±11.52	68.25±13.88	0.712
Gender (n,%)	Female	3 (%60)	8 (%66.7)	1.000
	Male	2 (%40)	4 (%33.3)	
Time Between Applying to the Emergency Department and Surgery (n,%)	<12 hour	2 (%40)	8 (%66.7)	0.593
	≥12 hour	3 (%60)	4 (%33.3)	
Preoperative leukocyte $x10^3$ (Mean±SD)		15.30±4.63	18.44±10.54	0.537
Postoperative leukocyte $x10^3$ (Mean±SD)		13.80±7.52	20.90±12.51	0.175
Platelet $x10^3$ (Mean±SD)		315.40±129.77	211.00±108.73	0.108
Arterial pH (Mean±SD)		7.34±0.12	7.32±0.96	0.782
Amilase (U/L) (Mean±SD)		168.60±102.96	112.83±121.065	0.399
Lactate (mmol/L) (Mean±SD)		3.45±1.70	3.41±1.29	0.961
Bicarbonate (HCO3) (mEq/L) (Mean±SD)		21.88±5.24	20.23±3.41	0.673
Lactate Dehydrogenase (U/L) (Mean±SD)		337.20±124.79	368.83±184.55	0.928

Table 3: Comparison of demographic and clinical data of patients who required and did not require additional resection during second look

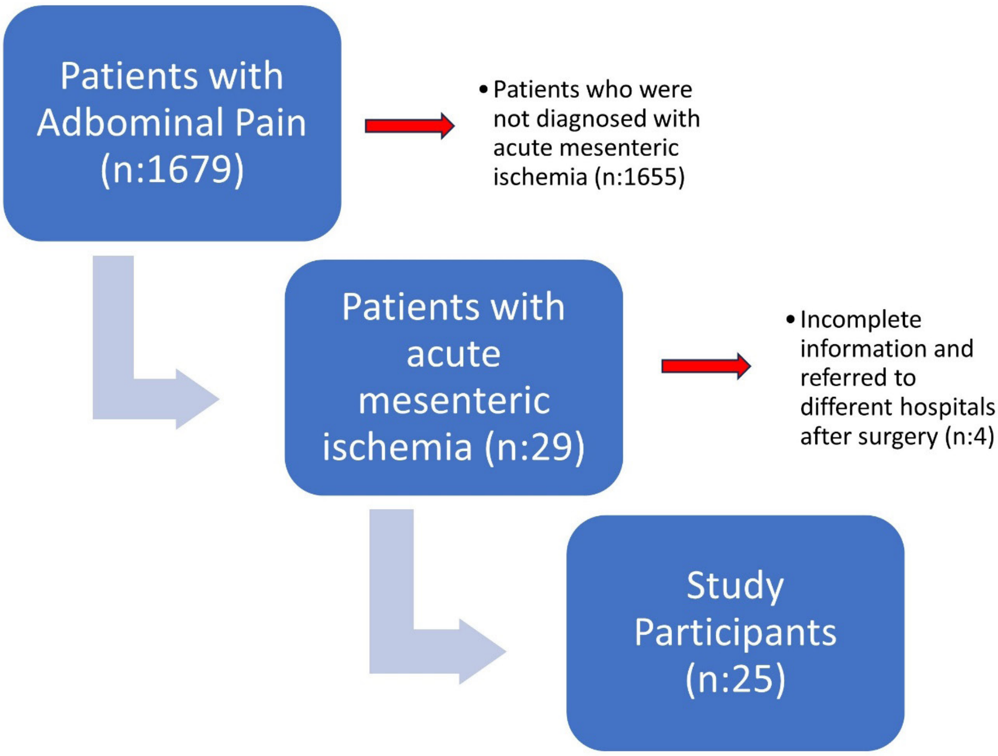

Figure 1: The flow diagram of study participants

Discussion

In 70-80% of AMI cases, ischemia occurs in the intestines due to mesenteric artery occlusion by an embolus or thrombus. Compared to other causes of acute mesenteric ischemia, embolic occlusion leads to early ischemia and transmural necrosis due to the absence of advanced collateral circulation [16]. Severe abdominal pain is a prominent symptom in AMI diagnosis, although it may be disproportionate to physical findings. Intestinal ischemia typically manifests before the onset of peritonitis and sepsis symptoms [17]. The intestines can tolerate a 75% reduction in blood flow for up to 12 hours, thanks to collaterals providing vasodilation and increased oxygen levels [19]. Prolonged ischemia, however, can lead to vasoconstriction in blocked vessels, resulting in increased pressure and decreased collateral blood flow [4,20]. Our study indicates lower postoperative mortality in patients diagnosed and operated on within 12 hours from emergency room admission, underscoring the impact of early diagnosis on mortality.

Acute mesenteric ischemia is frequently observed in elderly individuals, with some studies suggesting that increasing age is a poor prognostic sign for mesenteric ischemia. However, certain publications assert no relationship between age and AMI prognosis [17]. In our study, there was no significant age difference between surviving and deceased patients during the postoperative period.

Arterial emboli and thromboses typically result in obstructions in the superior mesenteric artery (SMA), while venous thromboses occur in the superior and inferior mesenteric veins, splenic veins, and portal veins [18]. Our study noted that in most patients, acute mesenteric ischemia (AMI) was caused by emboli or thromboses in the SMA.

Although the American College of Gastroenterology guidelines designate angiography as the gold standard for mesenteric ischemia diagnosis, non-invasive techniques like CT angiography are preferred due to their 96% sensitivity and 94% specificity, considering the invasiveness, limited accessibility, and time-consuming nature of angiography [11, 13, 14]. In our study, angiography was not performed due to its invasiveness and accessibility challenges; instead, an arterial CT angiography protocol was applied to the patients' CT scans.

Various laboratory tests have been explored for mesenteric ischemia or infarction diagnosis [25]. A review indicated that lactate levels provided 86% sensitivity and 44% specificity for AMI [26]. The specificity of elevated serum lactate levels significantly increases when conditions like shock, diabetic ketoacidosis, renal, and hepatic failure are excluded [27]. Approximately half of patients with intestinal ischemia have been observed to have elevated amylase levels, and about 80% have elevated phosphate levels [28-30]. Increased levels of blood urea, creatinine, and amylase, along with an increase in leukocyte count and changes in acidity, have been considered indicators of mortality in different studies [31, 32-36]. Although not statistically significant, some studies have reported that the development of leukopenia increases mortality and is associated with a decrease in the protective effect of the immune system [37]. In our study, among the examined blood parameters, only a significant increase in lactate levels was found in patients who experienced mortality during the postoperative period. Although no significant result was found among the parameters examined to determine the need for additional resection during secondary care, it is noteworthy that patients requiring additional resection had significantly higher postoperative leukocyte values and significantly lower platelet values.

The manuscript is limited by a small sample size, retrospective design, and a single-center focus, impacting the generalizability of the findings. Larger, diverse samples and prospective multi-center studies would enhance future research validity.

Conclusion

In summary, it is imperative to consider the potential occurrence of acute mesenteric ischemia (AMI) when assessing elderly individuals who present to the emergency room with abdominal pain and concurrent comorbidities. Vigilance and a high index of suspicion are crucial in managing these patients due to the absence of a definitive diagnostic test with both high sensitivity and specificity for mesenteric ischemia. Delays in diagnosis, exacerbated by the lack of a foolproof diagnostic tool, can contribute to increased mortality rates. Clinicians should take note of elevated leukocyte and lactate levels, which can serve as valuable indicators supporting the suspicion of AMI. The absence of a rapid and precise diagnostic method underscores the importance of relying on clinical clues such as these for timely intervention. Moreover, monitoring leukocyte values in the postoperative period becomes instrumental, as persistently high levels may signal the progression of ischemia. Recognizing these markers and promptly addressing them is essential for optimizing patient outcomes and potentially averting the need for more extensive secondary care measures.

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Conflict of Interest

None of the authors have a conflict of interest.

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