EXPERIMENTAL STUDY

Evaluation of intestinal necrosis with laser Doppler in experimental mesenteric ischemia model

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ABSTRACT

BACKGROUND: Acute mesenteric ischemia (AMI) is responsible for one in a thousand emergency hospital admissions in America and Europe and is associated with high morbidity and mortality rates. Current diagnostic and treatment methods fall short of desired outcomes, often resulting in delayed diagnoses and difficulties in detecting ischemic bowel tissue during treatment. This study evaluates the diagnostic value of commonly used biochemical markers in clinical practice—creatine kinase, C-reactive protein (CRP), and lactate dehydrogenase (LDH)—alongside blood flow measurements using laser Doppler in a rat model of experimental mesenteric ischemia. We also compare these markers with pathological ischemia scoring.

METHODS: Rats were divided into five groups: control, 1 hour, 2 hours, 3 hours, and 4 hours. Mesenteric ischemia was induced for the respective durations in each group. After these periods, we measured blood flow using laser Doppler. We also collected blood samples and intestinal biopsies for biochemical parameter analysis. These values were assessed in relation to intestinal viability using the Chiu ischemia scoring system.

RESULTS: Blood flow measurement with laser Doppler correlated with both the duration and severity of bowel ischemia. No significant relationship was found between CRP levels and the duration of ischemia. However, creatine kinase and lactate dehydrogenase (LDH) levels were significantly higher in ischemia lasting into the third and fourth hours.

CONCLUSION: Creatine kinase and lactate dehydrogenase (LDH) levels may be useful biomarkers in patients with suspected acute mesenteric ischemia (AMI). Blood flow measurements using laser Doppler can accurately identify intestinal loops for resection during surgery.

Keywords: C-reactive protein; creatine kinase; lactate dehydrogenase; laser Doppler; mesenteric ischemia.

INTRODUCTION

Mesenteric ischemia occurs due to insufficient splanchnic blood flow, which fails to meet the metabolic requirements of the intestines. It is typically classified as acute, chronic, non-occlusive, or venous ischemia, with acute mesenteric vascular embolism being the most common type.[1] The mesenteric arterial circulation comprises three main elements, which are branches of the abdominal aorta: the celiac trunk, the superior mesenteric artery (SMA), and the inferior mesenteric artery (IMA). The celiac trunk supplies blood to the stomach, the first and second parts of the duodenum, parts of the pancreas, liver, and spleen, whereas the SMA supplies the remaining part of the duodenum, jejunum, ileum, ascending colon, and proximal part of the transverse colon. The IMA provides blood to the distal transverse colon, descending colon, sigmoid colon, and proximal rectum. The SMA, being the primary artery for the small intestine, receives collateral branches

Cite this article as: Aksoy N, Kaplan DS, Orkmez M, Eronat Ö. Evaluation of intestinal necrosis with laser Doppler in experimental mesenteric ischemia model. Ulus Travma Acil Cerrahi Derg 2024;30:1-8.

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Ulus Travma Acil Cerrahi Derg 2024;30(1):1-8 DOI: 10.14744/tjtes.2024.38399 Submitted: 15.09.2022 Revised: 28.12.2023 Accepted: 03.01.2024

from the celiac trunk via the pancreaticoduodenal artery.[2]

The SMA is most frequently occluded by thrombi due to its exit angle from the aorta and its relatively large diameter compared to other mesenteric vessels.[3,4] This often leads to small bowel ischemia and can result in malabsorption conditions such as short bowel syndrome. Generally, when there is a stenosis exceeding 70% in the mesenteric arteries, an increase in collateral circulation is observed. Mesenteric blood flow accounts for 15-20% of the cardiac output during fasting and increases to 35% postprandially. The small intestines can tolerate a reduction of up to 75% in overall blood flow for as long as 12 hours.[5] However, irreversible ischemia occurs in less than 6 hours in the event of complete occlusion,[6] underscoring the critical need for early diagnosis and intervention in patients with mesenteric ischemia.

Acute mesenteric ischemia (AMI) constitutes one in every thousand emergency hospital admissions in America and Europe.[7] AMI is challenging to diagnose and often goes unrecognized when it results in death. In the United Kingdom, population-based analyses from a general practitioner database in a national study indicated an overall incidence of AMI at 0.63 per 100.000.[8] In Sweden, a population-based study with an autopsy rate of 87% reported an incidence of 12.9 per 100.000 people per year, which is 20 times higher than that detected through population-based screening.[9] It was also reported in the same study that 65% of acute superior mesenteric artery occlusions were diagnosed during autopsy.[9]

The incidence of mesenteric ischemia increases exponentially with age, with no significant gender difference. Although the mean age of onset is around 70 years, some cases have been reported in individuals in their 20s.[10-14] With the general population's aging, the incidence of comorbidities, as well as the disease itself, is increasing,[15] emphasizing the importance of diagnosis and treatment methods in societies with an aging population.

Since mesenteric ischemia is difficult to diagnose and symptom severity varies, intestinal necrosis often develops at the time of diagnosis, limiting surgical treatment options to bowel resection and revascularization attempts. Determining the extent of ischemia presents a significant challenge for surgeons. Intraoperative assessment of intestinal ischemia relies on subjective parameters like intestinal color, peristalsis, and the presence of pulsation, which are not reliably indicative of tissue viability.[16,17]

A reliable measurement method is crucial for determining not only blood flow but also tissue viability, essential for the healing of anastomosis.[18] The classical methods are not sufficiently reliable for decision-making, and there is a risk that the thrombus in the mesenteric vessel and ischemic bowel segments may progress postoperatively. The final evaluation of ischemic bowel segments is typically conducted via a second-look laparotomy, performed 24-48 hours after the initial surgery.[19] This poses a risk of a second operation, especially for elderly patients with comorbidities.

Defining the resection and anastomosis margins precisely is vital to prevent postoperative complications such as anastomotic leakage, short bowel syndrome, and nutritional disorders. These challenges underscore the need to distinguish between intestinal segments with sufficient blood flow for anastomosis healing and those without. Developing methods to make this distinction may enable surgeons to perform fewer second-look laparotomies.

Various methods are explored to evaluate the demarcation line in intestinal tissue with blood flow, including biochemical parameters, blood flow measurement using classical Doppler ultrasonography, tissue oxygen saturation, tissue light absorption at certain wavelengths, and capillary blood flow measurements with laser Doppler.

While studies have been conducted on blood flow measurement using laser Doppler in ischemia evaluation, no study has yet combined laser Doppler, serum plasma measurements, and pathological ischemia scoring. Our study aims to evaluate the time-related changes in biochemical parameters, capillary blood flow measurements with laser Doppler, and pathological tissue ischemia scoring in rats with experimental mesenteric ischemia.

MATERIALS AND METHODS

This study was conducted with the approval of the Gaziantep University Animal Experiments Local Ethics Committee, dated 09/03/2021, and protocol number 193. Literature reviews and statistical power analysis were performed to determine the number of rats to be included in each group for the study. Expecting a statistically significant difference of 24 units in the LDF (Laser Doppler Flowmetry) variable, the minimum sample size required in each group was determined to be 5 (α=0.05, 1-β=0.80). The study utilized 25 male Wistar albino rats, each weighing between 250-300 g. It is based on the hypothesis that certain biochemical parameters indicative of ischemia, in conjunction with laser Doppler measurements of blood flow, can be used to diagnose mesenteric ischemia early and precisely define the demarcation line intraoperatively. The experimental procedures were based on those described in previous studies.[20] The rats were divided into five groups: control, 1 hour, 2 hours, 3 hours, and 4 hours, with mesenteric ischemia induced for the respective durations. In the control group, all surgical procedures except arterial clamping were performed. The rats were housed in an environment with controlled ventilation, room temperature of 21±2°C, relative humidity of 40-60%, cage light intensity of 40 lux, a 12-hour light/dark cycle, and air change of 16 times per hour. All rats in both the control and experimental groups had free access to food and water until the experiment.

Surgical Procedure

Preoperatively, all the animals were prepared for the operation with intraperitoneal administration of 60 mg/kg ketamine

Table 1. Chiu intestinal ischemia scoring

Grade 0	Normal mucosa
Grade 1	Formation of subepithelial Gruenhagen spaces at the apex of the villi, usually with capillary congestion
Grade 2	Enlargement of the subepithelial space and mild separation of the epithelium in the lamina propria
Grade 3	Diffuse epithelial separation in the upper parts of the villi
Grade 4	Shedding of lamina propria and villi, capillary dilatation, increased cellularity in lamina propria
Grade 5	Digestion and deterioration of its integrity, bleeding and ulceration in the lamina propria

and 6 mg/kg xylazine. The abdominal hair was shaved, and the skin was prepared with 10% povidone iodine. The abdomen was opened with a midline incision, and the superior mesenteric artery (SMA) was exposed. The ischemia process was initiated by ligating the SMA with a prolene suture. The skin was closed with a prolene suture. Before relaparotomy, each animal was subjected to ischemia for the specified duration in its group. Relaparotomy was performed after 4 hours without SMA ligation only in the control group. During relaparotomy, intestinal blood flow was measured from the terminal ileum with laser Doppler at the 0th (SMA 0th min) and 15th (SMA 15th min) minutes of revascularization. Additionally, a 1 cm segment from the terminal ileum was resected for pathological examination. For biochemical examination, a 2 ml blood sample was collected from the inferior vena cava using a 16 gauge needle. At the end of the experiment, the animals were euthanized.

Laser Doppler

Measurement For capillary blood flow assessment, two measurements were taken at 0- and 15-minutes post-revascularization using the Perimed PeriFlux System 5000 (Perimed, Stockholm, Sweden) device. This device, which utilizes a 780 nm wavelength laser light, evaluates the area 0.5-1 mm beneath the surface. The laser beam, reflected by red blood cells in this area, is detected by the probe, yielding numerical measurement values as perfusion units. The device's probe was placed on the intestinal serosa without disturbing capillary blood flow, and the average value obtained after waiting for 1 minute during each measurement was recorded as the reference.

Histopathological Evaluation

Tissue samples taken for histological evaluation were preserved in 10% formaldehyde solution and examined under a microscope (Nikon e400, Nikon, Tokyo, Japan) using standard hematoxylin-eosin staining. The pathologist conducting the examinations was blinded to the animal groups and their blood flow measurements. The pathological scoring was based on the "pathological classification of intestinal ischemia" as defined by Chiu (Table 1).

Biochemical Evaluation

Blood samples were collected in standard biochemistry tubes, centrifuged at 5000 rpm for 10 minutes, and the plasma was subsequently separated. Plasma measurements of creatine kinase, LDH, and CRP were conducted using the Beckman Coulter AU5800 device (Japan).

Statistical Analysis

The behavior of quantitative variables was analyzed using measures of central tendency and variability. To assess the differences between group means, the Kruskal-Wallis H test (applicable when the number of groups exceeds two) was used, provided the assumptions of normality and homogeneity of variance were satisfied. The Bonferroni post hoc correction method was applied for multiple comparisons between groups. Statistical significance was established at $p \leq 0.05$ for all tests. Statistical analyses were conducted using IBM SPSS software (Statistical Package for the Social Sciences for Windows, Version 21.0, Armonk, New York, IBM Corp.).

RESULTS

Distribution statistics for numerical parameters are presented as mean value ± standard deviation and median value, along with minimum-maximum values (Table 2).

Table 2. Mean value and standard deviation; median value and minimum-maximum values

	Mean value and standard deviation	Median (Min-Max)
CRP	0.07±0.04	0.07 (0.01-0.13)
Chiu ischemia score	2.16±1.84	2 (0-5)
SMA 0th min. Doppler	46.13±47.11	37 (0-151)
SMA 15th min. Doppler	139.58±132.38	102 (0.7-413)
Creatine kinase	2500.76±2044.46	1412 (116-5000)
LDH	1731.76±1125.11	1749 (294-5019)

Table 3. Mean value and standard deviation, median value and minimum-maximum values of Chiu ischemia score

Group	1 Hour (5)	2 Hours (5)	3 hours (5)	4 hours (5)	p value
Mean±standard deviation	0.8±0.84	2.0±0.71	3.2±0.84	4.8±0.45	<0.001(a)
Median value (Min-Max)	1 (0-2)	2 (1-3)	3 (2-4)	5 (4-5)	

Table 4. Comparison of ischemia score between groups

Chiu ischemia score	p
1 hour vs. 2 hour	0.079
1 hour vs. 3 hour	<0.001
1 hour vs. 4 hour	<0.001
2 hour vs. 3 hour	0.079
2 hour vs. 4 hour	<0.001
3 hour vs. 4 hour	0.014

DISCUSSION

In our study, acknowledging that laser Doppler is affected by instantaneous movements, we graphed the one-minute measurements using a computer. The average value calculated from this graph was used to minimize this effect. The measurement taken at the time of SMA ligation release was used to evaluate the instantaneous blood flow at the end of ischemia. Additionally, the tissue's reperfusion capability was evaluated during the measurement taken after 15 minutes, allowing time for the reperfusion processes to progress. Consequently, we observed that capillary blood flow can quickly return to pre-ischemic values in early ischemia, but the tissue's reperfusion capability diminishes in prolonged ischemia (Tables 7 and 8). A 15-minute reperfusion period was deemed appropriate for simulating an operating room evaluation, as this duration is considered sufficient for vasodilation to occur, owing to the release of nitric oxide during reperfusion.

Acute mesenteric ischemia remains a complex and challenging clinical problem. Although CT angiography is predominantly used for diagnosis, early tomographic findings are non-specific, and late findings often appear after intestinal necrosis has developed.[21] This is particularly true in non-occlusive mesenteric ischemia, where direct vessel occlusion cannot be demonstrated, making accurate diagnosis challenging for clinicians. In the diagnostic phase, radiological methods may be insufficient, and specific laboratory tests are still in development. Despite extensive research, no early, sensitive, and specific biomarkers for acute intestinal ischemia have been identified to date.[22-24]

Total lactic acid is frequently used as a biochemical marker.[25,26] Both lactic acid and the lactate dehydrogenase enzyme are markers that increase rapidly in serum during tissue hypoperfusion. Our study found that while LDH elevation may guide clinicians in ischemias lasting longer than 3 hours, it is not decisive for newer ischemias (Tables 11 and 12).

Creatine kinase, another ischemia marker, is widely used in clinical practice. Studies by Graeber and Thompson have associated creatine kinase elevation with mesenteric ischemia.[28,29] Takahashi et al. reported no associations between CRP and LDH values with intestinal gangrene but did show a correlation with high creatine kinase levels.[30] In our study, we observed no significant increase in creatine kinase in the

Table 5. Laser Doppler measurements, mean value and standard deviation according to the groups at the time of SMA opening; median value and minimum-maximum values

Group	1 Hour (5)	2 Hour (5)	3 Hour (5)	4 Hour (5)	Control (5)	p-value
Mean value±standard deviation	49.0±9.35	38.2±3.96	12.4±9.4	1.68±2.37	129.4±21.8	<0.001(k)
Median value (Mİn-Max)	49 (35-61)	39 (32-42)	11 (0-24)	0 (0-5)	134 (99-151)	

Table 6. Comparison of laser Doppler measurements between groups at SMA opening

Laser Doppler measurement at SMA opening	p	Laser Doppler measurement at SMA opening	p
Control vs. 1 Hour	<0.001	1 Hour vs. 3 Hour	0.001
Control vs. 2 Hour	<0.001	1 Hour vs. 4 Hour	<0.001
Control vs. 3 Hour	<0.001	2 Hour vs. 3 Hour	0.016
Control vs. 4 Hour	<0.001	2 Hour vs. 4 Hour	0.001
1 Hour vs. 2 Hour	0.591	3 Hour vs. 4 Hour	0.597

Table 7. Laser Doppler measurement, mean value and standard deviation, median value and minimum-maximum values 15 minutes after SMA opening

Group	1 Hour (5)	2 Hour (5)	3 Hour (5)	4 Hour (5)	Control (5)	p-value
Mean value±standard deviation	166.6±16.79	107.0±13.8	48.6±9.5	7.9±5.75	367.8±72.04	<0.001(k)
Median value (Min-Max)	170 (144-189)	102 (93-128)	47 (39-62)	7.3 (0.7-15.7)	398 (240-413)	

Table 8. Comparison of the results of laser Doppler measurement 15 minutes after SMA opening according to groups

Laser Doppler measurement after 15 minutes of SMA opening	p	Laser Doppler measurement after 15 minutes of SMA opening	p
Control vs. 1 Hour	1	1 Hour vs. 3 Hour	0.317
Control vs. 2 Hour	0.317	1 Hour vs. 4 Hour	0.013
Control vs. 3 Hour	0.013	2 Hour vs. 3 Hour	1
Control vs. 4 Hour	<0.001	2 Hour vs. 4 Hour	0.317
1 Hour vs. 2 Hour	1	3 Hour vs. 4 Hour	1

Table 9. Mean value and standard deviation; median value and minimum-maximum values of serum CRP measurement

Group	1 Hour (5)	2 Hour (5)	3 Hour (5)	4 Hour (5)	Control (5)	p-value
Mean value±standard deviation	0.06±0.05	0.05±0.04	0.04±0.04	0.1±0.03	0.08±0.04	0.191(k)
Median value (Min-Max)	0.04 (0.01-0.12)	0.03 (0.02-0.11)	0.02 (0.01-0.08)	0.1 (0.06-0.13)	0.07 (0.03-0.13)	

1st and 2nd hour ischemia groups compared to the control group, but a significant increase was found in the 3rd and 4th hour ischemia groups (Tables 13 and 14). Moreover, no difference was found between the ischemia groups, suggesting that creatine kinase may indicate the presence of late ischemia in patients but does not provide clear information to the surgeon about the onset of ischemia.

CRP, one of the most commonly used acute phase reactants, can indicate mesenteric ischemia and the resultant bacterial translocation. However, some studies have found it insufficient to confirm the presence of mesenteric ischemia.[30] In our study, the results were in parallel with existing literature (Tables 9 and 10). Since CRP is not a specific marker for intestinal tissue, its elevated levels alone are not indicative of mesenteric ischemia, although it can be used as a supportive marker in conjunction with other findings.

The ideal test for determining intestinal viability should be easy to apply, reliable, cost-effective, and preferably available

Table 10. Comparison of CRP values between groups

CRP measurement	p	CRP measurement	p
Control vs. 1 Hour	0.904	1 Hour vs. 3 Hour	0.951
Control vs. 2 Hour	0.8	1 Hour vs. 4 Hour	0.523
Control vs. 3 Hour	0.523	2 Hour vs. 3 Hour	0.989
Control vs. 4 Hour	0.951	2 Hour vs. 4 Hour	0.389
1 Hour vs. 2 Hour	0.999	3 Hour vs. 4 Hour	0.186

Table 11. Mean value and standard deviation; median value and minimum-maximum values of LDH value according to groups

Group	1 Hour (5)	2 Hour (5)	3 Hour (5)	4 Hour (5)	Control (5)	p-value
Mean value±standard deviation	1328.8±835.4	1363.2±547.43	2473.0±586.16	2966.0±1178.83	527.8±297.99	0.002(k)
Median value (Min-Max)	1011 (521-2471)	1648 (730-1877)	2606 (1618-3000)	2667 (2109-5019)	475 (294-1033)	

Table 12. Comparison of LDH value between groups

LDH measurement	p	LDH measurement	p
Control vs.1 hour	1	1 hour vs. 3 hour	0.781
Control vs. 2 hour	1	1 hour vs. 4 hour	0.392
Control vs. 3 hour	0.013	2 hour vs. 3 hour	0.781
Control vs. 4 hour	0.004	2 hour vs. 4 hour	0.392
1 hour vs. 2 hour	1	3 hour vs. 4 hour	1

Table 13. Mean value and standard deviation; median value and minimum-maximum values according to groups in creatine kinase measurement

Group	1 Hour (5)	2 Hour (5)	3 Hour (5)	4 Hour (5)	Control (5)	p-value
Mean value±standard deviation	1077.2±294.61	2029.4±1802.53	4151.4±1162.33	4999.2±1.79	246.6±144.9	0.001(k)
Median value (Min-Max)	1154 (627-1412)	1050 (703-5000)	5000 (2839-5000)	5000 (4996-5000)	233 (116-487)	

Table 14. Comparison of creatine kinase value between groups

Creatine Kinase Measurement	p	Creatine Kinase Measurement	p
Control vs. 1 Hour	1	1 Hour vs. 3 Hour	0.519
Control vs. 2 Hour	0.469	1 Hour vs. 4 Hour	0.231
Control vs. 3 Hour	0.004	2 Hour vs. 3 Hour	1
Control vs. 4 Hour	0.001	2 Hour vs. 4 Hour	0.634
1 Hour vs. 2 Hour	1	3 Hour vs. 4 Hour	1

in every operating room.[31] Various methods for predicting intestinal viability have been described in the literature, with techniques like fluorescence and Doppler studies gaining wide acceptance. Doppler techniques using ultrasound or laser are simple and non-invasive but may inaccurately measure blood flow due to signals from adjacent large vessels and suffer from high false positive and negative rates. Laser Doppler, while easy to apply, is sensitive to motion, and movements from heartbeat, respiration, and intestinal peristalsis can cause measurement artifacts.[32]

The primary aim of studies on AMI is to differentiate between reversible and irreversible tissue ischemia and to identify tissues with sufficient blood flow for anastomosis healing. Reliable ischemia scoring can be achieved through pathological evaluation. Therefore, the goal of AMI research is to predict tissue ischemia status using various parameters. In our study, we evaluated the differences in biochemical parameters and laser Doppler measurements between groups by comparing them with pathological ischemia scores. Significant differences in ischemia scoring between the groups, depending on the time, allow for cross-comparison of ischemia onset time and status with other parameters (Tables 3 and 4). Studies that utilize the categories defined by Chiu's ischemia scoring system can effectively guide the approach to tissue treatment based on the severity of ischemia. Additionally, correlating other parameters (like biochemical and blood flow measurements) with ischemia scores could predict tissue ischemia status without needing a biopsy.

The most significant factor limiting our study is that the laser Doppler device was not available in every operating room and performing measurements through laser Doppler is a difficult task. When capillary blood flow is measured, factors such as the movement of the probe on the tissue, the pressure on the tissue, and room temperature can influence the result to be obtained from the measurements.

Laser Doppler has proven effective in diagnosing and monitoring chronic ischemic conditions such as median arcuate ligament syndrome.[33] In pig studies, impaired perfusion at the anastomosis site was evaluated, revealing that a 75% perfusion impairment, as opposed to a 25% reduction, severely affects anastomotic healing.[34] Another study used laser Doppler to measure microvascular blood flow at the anastomosis site to assess the risk of anastomotic leakage.[35] The use of visible light spectroscopy in conjunction with laser Doppler may also be beneficial in predicting gastric tube anastomotic leakage following esophageal cancer.[36] Laser Doppler is effective not only in demonstrating viability in free tissue flaps but also in distinguishing between arterial and venous occlusions.[37]

In a review examining second-look laparotomy outcomes post-bowel resection due to mesenteric ischemia, second-look laparotomy was performed in 312 (42.8%) of 728 patients, with positive findings in only 132 (42.3%) of these cases. Additionally, mortality rates in patients undergoing second-look laparotomy were found to be similar to those who did not.[19] These results suggest that the second-look procedure, often yielding no positive findings and not reducing mortality rates, should be replaced by more advanced methods.

CONCLUSION

Acute mesenteric ischemia (AMI) is particularly prevalent among the elderly population, and with the demographic shift towards an increasing number of older individuals, it has emerged as a significant public health concern. The challenges in diagnosis and treatment persist, often resulting in high mortality and morbidity rates. Given that patients typically present with non-specific symptoms, there is a critical need for disease-specific biochemical and radiological markers. Research in this domain should prioritize the development of supportive diagnostics that are practical, easy to apply, and reliable.

The management of AMI frequently varies based on the surgeon's experience and clinical judgment, and the quest for objective evaluation methods is ongoing. Assessing ischemic bowel tissue, which is paramount in patient management, remains an intricate challenge. Many surgeons opt for second-look surgeries as a means to address this uncertainty. However, these procedures can introduce additional risks, particularly for elderly patients with coexisting conditions. Often, these interventions are concluded without yielding positive findings and do not contribute to lowering mortality rates. Consequently, early diagnosis and the establishment of methods that can objectively determine intestinal viability are vital. Measurements of serum lactate dehydrogenase (LDH) and creatine kinase may assist in the diagnosis of AMI, while blood flow assessment with laser Doppler could prove crucial in evaluating intestinal viability.

Ethics Committee Approval: This study was approved by the University of Gaziantep Local Ethics Committee of Animal Experiments Ethics Committee (Date: 01.03.2021, Decision No: 2021/23).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: N.A.; Design: D.S.K.; Supervision: M.Ö.; Resource: Ö.E.; Materials: D.S.K.; Data collection and/or processing: Ö.E.; Analysis and/or interpretation: M.Ö.; Literature search: N.A.; Writing: N.A.; Critical review: N.A.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

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DENEYSEL ÇALIŞMA - *ÖZ*

Deneysel mezenter iskemi modelinde bağırsak nekrozunun lazer Doppler ile değerlendirilmesi

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AMAÇ: Akut mezenter iskemi (AMİ), Amerika ve Avrupa'daki acil hastane başvurularının 1/1000'ini oluşturmakta, mobidite ve mortalite oranları yüksek seyretmektedir. Tanı ve tedavisinde kullanılan yöntemler halen istenilen sonuçları vermekten uzaktır. Bu nedenle tanı konulması gecikebilmekte, tedavisinde iskemik barsak dokusunun saptanmasında zorluklar yaşanmaktadır. Çalışmamızda klinik pratikte sıklıkla kullanılan biokimyasal parametrelerden olan kreatin kinaz, C-reaktif protein (CRP), laktat dehidrojenazın (LDH) tanısal değerini ve doku iskemisini değerlendirmek için lazer Doppler ile kan akımı ölçümlerini sıçanlar üzerinde oluşturulan deneysel mezenter iskemi modelinde incelenmektedir. Bu değişkenler patolojik iskemi skorlaması ile de karşılaştırılmaktadır.
GEREÇ VE YÖNTEM: Sıçanlar sırasıyla kontrol, 1 saat, 2 saat, 3 saat, 4 saat olarak 5 gruba ayrılarak, her gruba kendisi için belirlenen sürede mezenter iskemi oluşması sağlandı. Bu süre sonunda lazer Doppler ile kan akımı ölçümü yapılarak biokimyasal parametre ölçümü içim kan örneği ve bağırsak biyopsisi alındı. Elde edilen değerler Chiu iskemi skorlaması kullanılarak bağırsak canlılığı ile ilişkisi değerlendirildi.
BULGULAR: Elde ettiğimiz sonuçlara göre lazer Doppler ile kan akımı ölçümü bağırsak iskemi süresi ve skoru ile ilişkili bulundu. CRP'nin iskemi süresi ile ilişkisi saptanamazken kreatin kinaz ve LDH, 3 ve 4 saat süren iskemilerde belirgin olarak yükseldi.
SONUÇ: Kreatin kinaz ve LDH, AMİ şüphesi olan hastalarda yol gösterici olabilir. Laser Doppler ile kan akımı ölçümü intraoperatif olarak rezeksiyon yapılacak bağırsak anslarının doğru tesbit edilmesinde kullanılabilir.

Anahtar sözcükler: C-reaktif protein; kreatin kinaz; laktat dehidrojenaz; mezenter iskemi; lazer Doppler.

Ulus Travma Acil Cerrahi Derg 2024;30(1):1-8 DOI: 10.14744/tjtes.2024.38399