INTERNATIONAL SEVEN JOURNAL
OF MULTIDISCIPLINARY
ISSN: 2764-9547

DIAGNOSIS OF MESENTERIC ISCHEMIA

DIAGNÓSTICO DA ISQUEMIA MESENTÉRICA

DIAGNÓSTICO DE LA ISQUEMIA MESENTÉRICA

https://doi.org/10.56238/isevmjv5n2-030

Receipt of originals: 03/12/2026 **Acceptance for publication:** 04/12/2026

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ABSTRACT

Mesenteric ischemia consists of a reduction in blood flow to the visceral organs, resulting in metabolic impairment, tissue injury, and, in advanced cases, intestinal necrosis. The acute form constitutes a surgical emergency with high mortality, especially when diagnosis is delayed, whereas the chronic form presents an insidious course, often associated with atherosclerotic disease. The initial clinical presentation, frequently nonspecific, makes early recognition difficult, requiring a high degree of clinical suspicion. Biphasic computed tomography angiography is currently the main diagnostic method, allowing the identification of vascular occlusions and secondary changes associated with intestinal ischemia. In contrast, laboratory tests such as lactate and D-dimer have low specificity and are useful only as auxiliary tools. Additionally, emerging biomarkers, such as intestinal fatty acid-binding protein, show potential for early detection of lesions, although they are not yet widely established in clinical practice. In this context, the present study aimed to review the main diagnostic methods for mesenteric ischemia, with emphasis on imaging exams, clinical findings, and biomarkers. This is a narrative literature review based on the analysis of recent studies on the topic. The findings reinforce that the diagnostic approach depends on the integration of clinical suspicion and imaging methods, which is essential for appropriate therapeutic management and reduction of mortality.

Keywords: Mesenteric Ischemia. Diagnosis. Computed Tomography Angiography. Acute Mesenteric Ischemia. Biomarkers.

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RESUMO

A isquemia mesentérica consiste na redução do fluxo sanguíneo para os órgãos viscerais, resultando em comprometimento metabólico, lesão tecidual e, em casos avançados, necrose intestinal. A forma aguda configura uma emergência cirúrgica de elevada mortalidade, especialmente quando há atraso no diagnóstico, enquanto a forma crônica apresenta evolução insidiosa, frequentemente associada à doença aterosclerótica. A apresentação clínica inicial, frequentemente inespecífica, dificulta o reconhecimento precoce, exigindo elevado grau de suspeição clínica. A angiotomografia computadorizada bifásica é atualmente o principal método de diagnóstico, permitindo a identificação de oclusões vasculares e alterações secundárias associadas à isquemia intestinal. Em contrapartida, exames laboratoriais, como o lactato e dímero-D, apresentam baixa especificidade, sendo úteis apenas como ferramentas auxiliares. Além disso, biomarcadores emergentes, como a proteína de ligação de ácidos graxos intestinais, apresentam potencial na detecção precoce das lesões, embora ainda não estejam amplamente estabelecidos na prática clínica. Nesse contexto, o presente estudo teve como objetivo revisar os principais métodos diagnósticos da isquemia mesentérica, com ênfase em exames de imagem, achados clínicos e biomarcadores. Trata-se de uma revisão bibliográfica narrativa, baseada na análise de estudos recentes sobre o tema. Os achados reforçam que a abordagem diagnóstica depende da integração entre suspeita clínica e métodos de imagem, sendo essencial para a adequada condução terapêutica e redução da mortalidade.

Palavras-chave: Isquemia Mesentérica. Diagnóstico. Angiotomografia Computadorizada. Isquemia Mesentérica Aguda. Biomarcadores.

RESUMEN

La isquemia mesentérica consiste en la reducción del flujo sanguíneo hacia los órganos viscerales, lo que resulta en compromiso metabólico, lesión tisular y, en casos avanzados, necrosis intestinal. La forma aguda constituye una emergencia quirúrgica de alta mortalidad, especialmente cuando existe retraso en el diagnóstico, mientras que la forma crónica presenta una evolución insidiosa, frecuentemente asociada a la enfermedad aterosclerótica. La presentación clínica inicial, a menudo inespecífica, dificulta el reconocimiento precoz, lo que requiere un alto grado de sospecha clínica. La angiografía por tomografía computarizada bifásica es actualmente el principal método diagnóstico, permitiendo la identificación de oclusiones vasculares y cambios secundarios asociados a la isquemia intestinal. En contraste, los exámenes de laboratorio, como el lactato y el dímero D, presentan baja especificidad y son útiles solo como herramientas auxiliares. Además, biomarcadores emergentes, como la proteína de unión a ácidos grasos intestinales, muestran potencial para la detección precoz de las lesiones, aunque aún no están ampliamente establecidos en la práctica clínica. En este contexto, el presente estudio tuvo como objetivo revisar los principales métodos diagnósticos de la isquemia mesentérica, con énfasis en estudios de imagen, hallazgos clínicos y biomarcadores. Se trata de una revisión bibliográfica narrativa basada en el análisis de estudios recientes sobre el tema. Los hallazgos refuerzan que el enfoque diagnóstico depende de la integración entre la sospecha clínica y los métodos de imagen, siendo esencial para la adecuada conducción terapéutica y la reducción de la mortalidad.

Palabras clave: Isquemia Mesentérica. Diagnóstico. Angiografía por Tomografía Computarizada. Isquemia Mesentérica Aguda. Biomarcadores.

1 INTRODUCTION

Mesenteric ischemia occurs when blood flow to the visceral organs is insufficient to meet normal metabolic demands, resulting in tissue injury that can progress to intestinal necrosis and multiple organ failure (Audu et al., 2024). Clinically, the condition is divided into acute and chronic forms. Acute mesenteric ischemia (AMI) is a catastrophic surgical emergency, with mortality rates ranging between 60% and 80% if diagnosis is delayed, while chronic mesenteric ischemia (BMI) manifests insidiously, usually associated with atherosclerosis (Bala et al., 2022; Lendzion et al., 2022).

The pathogenesis of MAI is classified into four main categories: mesenteric arterial embolism (the most common), mesenteric arterial thrombosis, mesenteric venous thrombosis (TVM), and non-occlusive mesenteric ischemia (NOMI) (Bala et al., 2022; Yu & Kirkpatrick, 2023). The biggest clinical challenge lies in the nonspecificity of the initial symptoms, which often leads to misdiagnosis and delay in revascularization (Audu et al., 2024). Given the concept that "time is gut", early diagnosis and the use of advanced imaging protocols are vital for preserving intestinal viability and reducing lethality (Lendzion et al., 2022; Yu & Kirkpatrick, 2023).

The classic clinical manifestation of acute mesenteric ischemia is characterized by severe, sudden-onset abdominal pain that is disproportionate to the findings found during the patient's physical examination. Due to the prevalence of the pathology in elderly populations and the presence of multiple underlying medical comorbidities, the initial symptoms may often be nonspecific, which requires a high index of clinical suspicion from the examiner, especially in individuals with a history of atrial fibrillation, mechanical heart valve prostheses, or preexisting peripheral vascular disease. While embolic events tend to present with rapid progression and acute symptoms, arterial thrombosis may manifest more subacutely, and mesenteric venous thrombosis usually evolves with vague abdominal symptoms that progress slowly over weeks as venous congestion intensifies (OLSON; TEIXEIRA, 2021).

In the context of chronic mesenteric ischemia, the presentation is marked by chronic postprandial abdominal pain, often associated with significant weight loss and sitophobia, or fear of eating, due to the discomfort subsequent to ingestion. On the other hand, non-occlusive mesenteric ischemia represents the most insidious form of the disease, ranging from asymptomatic states to frank peritonitis, occurring predominantly in critically ill patients with prolonged use of vasopressors, hypotension, or abdominal

compartment syndrome. It is noteworthy that conventional laboratory tests remain unreliable for definitive diagnosis, and the maintenance of normal serum lactate levels is not sufficient to exclude the presence of active intestinal ischemia (OLSON; TEIXEIRA, 2021).

The diagnosis of non-occlusive mesenteric ischemia is particularly complex because ischemia is segmental or discontinuous and occurs without a macroscopic organic obstruction in the mesenteric vessels. Key risk factors include older age, patients undergoing hemodialysis, postoperative heart disease, sepsis, diabetes, and the use of drugs such as digitalis, catecholamines, or diuretics. Symptoms, although nonspecific, may involve severe abdominal pain, vomiting, diarrhea, and gastrointestinal hemorrhage, as well as signs such as ileus, increased waist circumference, and gastric reflux. Currently, multidetector computed tomography with dynamic protocol has assumed a central role in diagnostic investigation, although angiography has historically been considered the gold standard. Auxiliary biomarkers, such as intestinal fatty acid-binding protein, have shown potential for the early detection of mucosal damage, surpassing in accuracy traditional indicators such as aspartate aminotransferase and lactate dehydrogenase (KAWADA et al., 2025).

Regarding the predictors of mortality in acute mesenteric ischemia, evidence indicates that demographic factors and previous comorbidities have a decisive impact on the prognosis of patients. Variables such as age over sixty years, functional dependence of the patient, presence of arrhythmias, heart failure, and chronic kidney disease are statistically associated with fatal outcomes. From the clinical and laboratory point of view, the presence of hypotension, high creatinine and lactate levels, in addition to the need for inotropic support, are indicators of poor prognosis. The extent of intestinal involvement, specifically the simultaneous involvement of the small intestine and the large intestine, as well as the delay in surgical intervention of more than six hours, are critical factors that substantially increase the lethality rate (SUMBAL; BAIG; SUMBAL, 2022).

2 METHODOLOGY

The present study is characterized as a narrative literature review, with a qualitative approach and descriptive character, whose objective was to critically analyze the current scientific evidence related to the diagnosis of mesenteric ischemia. The construction of the study followed the methodological recommendations for narrative

reviews in the medical field, prioritizing recent, relevant literature with adequate scientific consistency.

The bibliographic search was carried out in the PubMed/MEDLINE databases, selected for their wide coverage in the biomedical area. The controlled descriptors of the Medical Subject Headings (MeSH) "Mesenteric Ischemia", "Diagnosis", "Computed Tomography" and "Biomarkers" were used, combined by the Boolean operators AND and OR, in order to increase the sensitivity of the search.

Articles published from 2020 to 2025, available in full, in English and Portuguese, that specifically addressed diagnostic aspects of mesenteric ischemia, including clinical evaluation, laboratory tests, and imaging methods, were included. International guidelines and relevant systematic reviews were also incorporated to ensure greater scientific robustness. Studies with an exclusive focus on surgical or therapeutic treatment, duplicate publications, isolated case reports, and articles with low methodological rigor were excluded.

The selection of studies occurred in two stages: initially, the screening by titles and abstracts was carried out, followed by the complete reading of the potentially eligible texts, in order to confirm the relevance to the proposed theme.

In addition, reference publications provided by the author were included, which contributed to the theoretical deepening and updating of the content, especially with regard to the accuracy of imaging methods and the importance of early diagnosis. Contrast-enhanced computed tomography, especially in angiographic protocols, was considered as a central examination in the diagnostic evaluation, as evidenced in the recent literature (YU; KIRKPATRICK, 2022). Likewise, contemporary reviews reinforce the role of clinical suspicion associated with complementary tests in the early identification of the disease (AHMED, 2021).

The extracted data were organized in a descriptive and thematic way, allowing the synthesis of the main evidence related to diagnostic methods, their clinical applicability and limitations. Finally, the results were interpreted in the light of the current literature, aiming to provide an integrated and updated view of the diagnosis of mesenteric ischemia.

3 RESULTS

Contemporary literature establishes biphasic CT angiography as the gold standard for the diagnosis of acute mesenteric ischemia, with sensitivity and specificity greater than 90% (Bala et al., 2022; Yu & Kirkpatrick, 2023). The biphasic protocol, which includes an arterial phase and a venous/enteric phase, allows for the direct identification of vascular occlusions, such as emboli in the superior mesenteric artery (SMA) or filling defects in the superior mesenteric vein (Yu & Kirkpatrick, 2023). Indirect tomographic findings include thickening of the intestinal wall, absence of parietal enhancement (sign of distress loop), intestinal pneumatosis (presence of gas in the wall of the intestine), and gas in the portal venous system—the latter two being indicators of transmural intestinal infarction and worse prognosis (Yu & Kirkpatrick, 2023; Bala et al., 2022). CT angiography is also very important for determining the treatment plan, since, based on the analysis of the abnormalities evidenced by the exam, it is possible to assess whether the patient has a therapeutic indication to perform conventional angiography or whether emergency surgery will be necessary (Yu & Kirkpatrick, 2023).

It was previously believed that a three-phase protocol, which would involve the addition of a non-contrast-enhanced phase, could increase the sensitivity of CTA for the diagnosis of mesenteric ischemia. However, a study later found that the triphasic protocol is no more beneficial than the biphasic protocol for the diagnosis of ischemia. Consequently, the three-phase protocol has not been widely implemented (Yu & Kirkpatrick, 2023).

Currently, the Dual Energy CT (DECT) is considered a promising tool to evaluate MAI, as it has the power to improve the detection of iodinated contrast by providing greater contrast attenuation and thus allowing a better evaluation of vascular structures. Thus, subtle perfusion anomalies, vascular filling defects will be more easily observed, or also in cases of suboptimal contrast administration or inadequate acquisition time (Yu & Kirkpatrick, 2023).

Regarding laboratory biomarkers, evidence indicates that there is no ideal single marker. Individuals with acute mesenteric ischemia clinically present with metabolic acidosis, elevated lactate, leukocytosis, and elevated D-dimer. However, such laboratory tests are nonspecific and, therefore, cannot be used alone to confirm the occurrence of AMI (Lendzion et al., 2022). Serum lactate, although widely used, is considered a late marker, rising significantly only after the onset of intestinal necrosis (Bala et al., 2022;

Audu et al., 2024). D-dimer has high sensitivity to exclude acute arterial occlusion when levels are normal, but its low specificity limits positive diagnostic value in critically ill patients (Bala et al., 2022). New markers, such as intestinal fatty acid-binding protein (I-FABP), are under investigation for their ability to detect early epithelial damage, but still lack standardization for routine use (Ahmed, 2021).

Due to the clinical similarity, it is not uncommon for suspected cases of AMI to be misdiagnosed as ischemic colitis. The diseases differ in their pathophysiology and severity. Ischemic colitis is related to temporary hypoperfusion or occlusion of small vessels, usually in patients with thrombogenic disorders or cardiac embolism, such as those admitted to the ICU who underwent aortic surgeries associated with hypovolemic shock. Therefore, ischemic colitis has no potential for large vessel occlusion and also presents with angiography without abnormal findings. Unlike AMI, ischemic colitis is self-limiting in nature, with a good response to conservative treatment with volume replacement, antibiotic therapy, and intestinal decompression. Only patients with complications can eventually benefit from a surgical procedure (Lendzion et al., 2022).

In chronic mesenteric ischemia (BMI), the clinical diagnosis is based on the triad of postprandial abdominal pain ("abdominal angina"), fear of eating (*food fear*), and progressive weight loss (Audu et al., 2024; Ahmed, 2021). Different tests can be performed to evaluate individuals with possible BMI. Among these exams are mesenteric Doppler ultrasound, magnetic resonance angiography (MRA), computed tomography angiography (CTA), and contrast-enhanced angiography (Audu et al., 2024). Doppler ultrasound of the mesenteric arteries is useful as an initial screening tool to detect significant strictures, showing a good correlation with CTA in experienced centers (Audu et al., 2024). The disadvantage of Doppler ultrasound is that such an exam requires an experienced professional to perform it, in addition to being an exam that can be limited by obesity and the presence of intestinal gas. Regarding CTA, it can complement or replace Doppler in the diagnostic investigation. CT angiography can show the mesenteric vessels in detail, so that it is essential for planning surgical treatment. Contrast-enhanced MRI angiography is less widely used, but it elucidates interesting functional information. Contrast-enhanced angiography is currently used when the objective is to perform a therapeutic intervention at the same time as the diagnostic evaluation is carried out (Audu et al., 2024). Non-occlusive MAI (NOMI), common in ICU patients using vasopressors, remains the most difficult subtype to diagnose, often requiring confirmation via

conventional angiography or diagnostic laparoscopy in the face of persistent clinical suspicion (Lendzion et al., 2022; Bala et al., 2022).

In addition to the specific findings of each method, the literature demonstrates that the diagnosis of mesenteric ischemia should not be based on a single isolated test, but on the integration between clinical, laboratory, and imaging data (Bala et al., 2022; Audu et al., 2024). The combination of clinical suspicion, especially in the face of abdominal pain disproportionate to the physical examination, and the early performance of computed tomography angiography contributes to greater diagnostic accuracy and faster definition of the therapeutic approach (Bala et al., 2022; Yu & Kirkpatrick, 2023). On the other hand, the isolated use of biomarkers or laboratory tests is limited, reinforcing the central role of imaging methods in confirming the diagnosis and directing clinical management (Bala et al., 2022; Audu et al., 2024).

4 DISCUSSION

The discussion on the diagnosis of mesenteric ischemia emphasizes the paradigm shift from catheter angiography (formerly the gold standard) to CTA. The speed and non-invasive character of modern tomography allow the surgeon to plan the intervention (whether endovascular or open) with anatomical precision (Yu & Kirkpatrick, 2023; Bala et al., 2022). The classic clinical sign of "pain disproportionate to physical examination" remains the most important diagnostic clue in arterial AMI; however, Lendzion et al. (2022) warn that the absence of peritonitis does not exclude severe ischemia, as peritoneal irritation appears only when necrosis reaches the outer layers of the intestine.

The management of mesenteric venous thrombosis (MVT) requires a specific diagnostic approach, focused on identifying underlying hypercoagulable states. Acosta & Salim (2021) highlight that CT in the portal phase is diagnostic in most cases, allowing the early initiation of anticoagulation, which can reverse the condition without the need for surgery in uncomplicated cases. In contrast, in NOMI, the diagnosis is often one of exclusion. The reduction in mortality associated with this condition depends on the early recognition of low-output states and immediate hemodynamic optimization (Bala et al., 2022).

It is concluded that the diagnosis of mesenteric ischemia requires a high index of clinical suspicion and the prompt execution of a biphasic CTA. Integrating clinical findings (such as postprandial pain in BMI or sudden pain in IMA) with imaging technologies allows

the multidisciplinary team to intervene before tissue damage is irreversible. The future of diagnostics lies in developing more sensitive point-of-care biomarkers and improving the detection of intraoperative bowel viability via technologies such as fluorescence angiography with indocyanine green (Lendzion et al., 2022; Yu & Kirkpatrick, 2023).

5 CONCLUSION

Mesenteric ischemia remains a highly severe condition, whose prognosis is directly related to the speed of diagnosis and therapeutic intervention. The non-specificity of the initial clinical manifestations presents one of the main obstacles to the early recognition of the disease, reinforcing the need for a high degree of clinical suspicion, especially in patients with associated risk factors. In this scenario, biphasic computed tomography angiography stands out as the main diagnostic method, allowing the early identification of vascular alterations and indirect signs of ischemia, in addition to assisting in the definition of the therapeutic approach. On the other hand, laboratory tests and biomarkers, although useful as complementary tools, have important limitations when used in isolation. Thus, the diagnostic approach should be based on the integration between clinical, laboratory, and imaging data, enabling a more accurate and timely conduction. Finally, advances in the development of more sensitive biomarkers and imaging technologies tend to improve the early detection of the disease, with a direct impact on reducing mortality.

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