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Authors' Affiliation:
[1]University Hospital in Poznań, Przybyszewskiego 49, 60-355 Poznań, Poland
[2]District Health Center in Otwock, Batorego 44, 05-400 Otwock, Poland
[3]Warsaw Southern Hospital, Rotmistrza Witolda Pileckiego 99, 02-781 Warszawa, Poland
[4]Medical Hospital in Garwolin, Lubelska 50, 08-400 Garwolin, Poland
[5]Centre of Postgraduate Medical Education, Orłowski Hospital, Czerniakowska 231, 00-416, Warsaw, Poland

*Corresponding Author
University Hospital in Poznań, Przybyszewskiego 49, 60-355 Poznań, Poland
Email: olajonkisz@gmail.com

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Mesenteric ischemia - a rare but fatal cause of abdominal pain. A literature review

Aleksandra Jonkisz[1*], Seweryn Rozalczyk[1], Gabriela Skurzyńska[2], Zuzanna Bałoniak[3], Agnieszka Leszyńska[1], Julia Bałoniak[1], Michalina Doligalska[4], Aleksandra Stremel[5], Aleksandra Anioła[1], Sandra Ważniewicz[1]

ABSTRACT

Mesenteric ischemia is an uncommon condition with unspecific symptomatology, making it difficult to diagnose. It arises from inadequate blood flow through the visceral arteries due to chronic or acute obstruction. The disease primarily affects women over the age of 60 with many other comorbidities. There is a division into chronic and acute depending on the onset of symptoms and timing of occlusion. The most common cause of chronic vascular insufficiency is atherosclerosis, which narrows or completely occludes the arteries. Clinical symptoms due to developed collateral circulation, occur scarcely in advanced atherosclerotic vascular disease. Patients suffering from chronic mesenteric ischemia complain of severe, postprandial abdominal pain. It usually is "out of proportion" to the physical examination. These patients lose weight as a result of fear of eating. Mesenteric ischemia can also be the result of an acute embolism or thrombosis. The symptoms of mesenteric ischemia are unspecific and can mimic many other more common conditions, including infectious, inflammatory, and malignant diseases. Its severity depends on the ability of collateral vascularisation to prevent malperfusion. As a result, diagnosis is often delayed or missed. Chronic as well as acute mesenteric ischemia can lead to multisystem organ failure, intestinal necrosis, and death. Treatment is based on surgical revascularization. The mortality rate of untreated disease remains high, and the chance of survival decreases over time. This article highlights the importance of including visceral ischemia in the differential diagnosis of abdominal pain and providing proper tests for its identification. Early recognition is crucial in decreasing mortality.

Keywords: Mesenteric ischemia, abdominal angina, atherosclerosis, embolism, thrombus

1. INTRODUCTION

Mesenteric ischemia (MI) is a rare but serious condition causing abdominal pain due to occlusion of the celiac trunk or mesenteric arteries and inadequate perfusion versus metabolic requirements (Mahajan et al., 2023; Audu et al., 2023). The disease mainly affects the elderly, especially women, and is associated with a high mortality rate (Mahajan et al., 2023). MI is a challenging issue for clinicians due to its unspecific presentation (Audu et al., 2023). The pathophysiological mechanism of chronic form is similar to vascular disorders in conditions such as angina pectoris or intermittent claudication (Mahajan et al., 2023). Chronic mesenteric ischaemia (CMI), also known as abdominal angina, is mainly a result of multivessel stable atherosclerosis. It usually occurs postprandial, leading to pain, fear of eating, and subsequent alarming weight loss (Mahajan et al., 2023; Yaari et al., 2023).

Blood supply is maintained in these patients by collateral circulation (Yaari et al., 2023). The presence of collateral pathways means that the symptoms of the disease do not appear until it has reached a high stage. Typically, two of the three main vessel trunks must be obstructed to trigger symptoms (Audu et al., 2023). Moreover, patients with CMI are predisposed to acute ischemia, which usually occurs during a new arrhythmia or illness (Audu et al., 2023). Acute mesenteric ischemia (AMI) is caused by acute occlusion of the artery by an embolus or thrombus, most frequently the superior mesenteric artery (Yaari et al., 2023). AMI is the equivalent of acute myocardial infarction, ischemic stroke or acute limb ischemia (Mahajan et al., 2023). Abnormal perfusion can progress to gut necrosis, multisystem organ failure, and eventually be fatal (Yaari et al., 2023; Audu et al., 2023)

2. METHODOLOGY

This paper comprehensively reviews some of the literature about a rare condition - mesenteric ischemia. We created an article highlighting the importance of increasing awareness of this disease to improve patient's prognosis and reduce mortality. Literature was sourced from the PubMed database. The review included meta-analyses, observational studies, and systematic reviews. Relevant articles were identified using search terms such as "mesenteric ischemia", "abdominal angina", "chronic mesenteric ischemia", "acute mesenteric ischemia". Trials were selected if they focused on symptoms and the choice of appropriate tests for early diagnosis and treatment.

3. RESULTS AND DISCUSSION

Epidemiology

It mainly affects people over the age of 60, mostly with multiple comorbidities, but has also been reported in younger people (Mahajan et al., 2023; Audu et al., 2023). Women are 3 times more likely to develop the condition than men, which can be related to more acutely curved branches of the arteries (Mahajan et al., 2023; Wu and Nanjundappa, 2024). Symptoms are usually unspecific, which is why MI remains under-recognized (Mahajan et al., 2023). The condition has a high mortality rate in the range of 60% to 95% in case of CMI and 17-21% in case of AMI (Mahajan et al., 2023; Audu et al., 2023).

Morbidity depends on the duration of the vessel occlusion and the presence of collateral circulation (Wu and Nanjundappa, 2024). When it comes to AMI, it has been shown that if diagnosis of SMA embolism takes more than 24 hours after the first symptoms, the survival rate drops from around 50% to 30% (Audu et al., 2023). Despite the widespread availability of CT as a primary diagnostic tool and new endovascular techniques, survival has not changed significantly in recent years (Hess et al., 2023)

Etiology and pathophysiology

The three primary branches of the aorta that supply blood to the internal organs are the celiac artery (CA), which supplies the stomach, liver, spleen, and intestines by the gastroduodenal artery; the superior mesenteric artery (SMA), which supplies the duodenum, pancreas, small intestine and ascending colon; and the inferior mesenteric artery (IMA), which supplies the rest of the colon and proximal rectum (Audu et al., 2023; Wu and Nanjundappa, 2024). The branches of these trunks are interconnected, further protecting against ischemia (Wu and Nanjundappa, 2024). Nevertheless, there are many possible anatomic variants due to the separate embryonic development of the aorta and the primitive ventral artery (Audu et al., 2023). Ischemia is a consequence of inadequate blood supply to the organs (Mahajan et al., 2023).

In a chronic process, symptoms usually occur when there is an increased demand for blood. This happens particularly after a meal, when blood flow in the gastrointestinal tract physiologically increases from regular 20% to approximately 35% of cardiac output (Mahajan et al., 2023; Audu et al., 2023). The most common cause of chronic abdominal angina, accounting for 90% of cases, is atherosclerosis (Mahajan et al., 2023; Audu et al., 2023). It reduces the size of the arteries, decreasing blood flow. Atherosclerosis has a predilection for depositing plaques at the ostia of the arteries (Mahajan et al., 2023). Major risk factors for atherosclerosis are long term smoking, hyperlipidaemia, hypertension and diabetes (Mahajan et al., 2023; Wu and Nanjundappa, 2024). Atherosclerotic stenosis of the mesenteric arteries is widespread, with a total prevalence of 29% and up to 67% in patients over the age of 80 (Wu and Nanjundappa, 2024).

However, due to the chronic nature of CMI and the progressive development of collateral vessels, patients do not become symptomatic until two of the three mesenteric arteries become significantly narrowed or occluded (Audu et al., 2023). Then, there is insufficient collateral and primary circulation (Audu et al., 2023). Other rare causes of CMI are the median arcuate ligament syndrome (MALS)/Dunbar syndrome resulting in celiac axis compression, vasculitis, systemic lupus, thromboangitis obliterans disease, radiation arteritis, spontaneous dissection, mesenteric venous stenosis, fibromuscular dysplasia, retroperitoneal fibrosis, neurofibromatosis, mesenteric venous stenosis, aortic coarctation, and drug-induced arteriopathy (Oliveira et al., 2019; Chaudhary et al., 2011; Audu et al., 2023; Wu and Nanjundappa, 2024).

Acute mesenteric ischemia is the result of arterial embolism in up to 50% of cases, usually due to cardiac causes such as arrhythmia, heart failure, myocardial infarction, or aneurysm (Audu et al., 2023). The SMA is the most common site of embolism due to its large size and skewed angle. It generally stops in the distal part of the middle colic artery (Audu et al., 2023; Wu and Nanjundappa, 2024). The second cause, accounting for up to 35% of cases, is thrombosis, usually in patients with pre-existing atherosclerosis. It is called acute-on-chronic mesenteric ischemia (Mahajan et al., 2023; Audu et al., 2023; Wu and Nanjundappa, 2024). Symptomatic CMI in approximately 20% to 50% of cases will progress to acute-on-chronic ischemia (Wu and Nanjundappa, 2024).

In summary, if we admit a patient with acute pain in the abdomen and previous history of CMI symptoms, we should highly suspect AMI (Wu and Nanjundappa, 2024). Thrombosis mainly occurs close to SMA origin, which results in a fulminant course and higher mortality (Mahajan et al., 2023; Audu et al., 2023). Other causes include venospasm, portal and mesenteric venous thrombosis which can be a result of infection, trauma, inflammatory bowel disease or hypercoagulability (Audu et al., 2023; Wu and Nanjundappa, 2024). Splanchnic hypoperfusion, known as non-occlusive ischemia, is also likely to occur in septic shock, low cardiac output, hypovolemia, or after vasoconstrictive drugs (Wu and Nanjundappa, 2024).

Clinical manifestation

Symptoms of mesenteric ischemia are frequently unspecific and can mimic other diseases like gastric ulcers, chronic pancreatitis, chronic cholecystitis, appendicitis, diverticulitis, bowel obstruction, or malignancy (Kuczyńska et al., 2020; Audu et al., 2023). In AMI, the predominant symptom is poorly localized abdominal pain, seen in up to 80% of cases (Wu and Nanjundappa, 2024). Patients can also complain of refractive diarrhea, nausea, vomiting, intestinal blockage, melena, overall malaise, or change of psychological state in the elderly (Kuczyńska et al., 2020; Audu et al., 2023; Wu and Nanjundappa, 2024). Ischemia can progress to peritonitis or even sepsis (Wu and Nanjundappa, 2024). The classic triad of abdominal pain, fever, and bloody bowel movements appears in only one-third of cases (Wu and Nanjundappa, 2024).

The proper diagnosis is often delayed, preceded by extensive tests, including laboratory tests, gastroscopy, colonoscopy, and various types of imaging (Kuczyńska et al., 2020; Audu et al., 2023). CMI predominantly manifests with severe pain described as cramping or dull, occurring postpartially and lasting for a few hours, slowly expiring (Mahajan et al., 2023; Wu and Nanjundappa, 2024). Patients are trying to adapt by eating less or avoiding food at all; it implies weight loss occurring in over 60% of patients (Wu and Nanjundappa, 2024). That is why stomach aches in CMI accompanied by weight reduction, malnutrition, or even cachexia can give a suspect of malignant processes in the gastrointestinal tract and range away from proper diagnosis (Kuczyńska et al., 2020).

On physical examination the abdomen is soft with no peritoneal signs. Auscultation may reveal a bruit (Mahajan et al., 2023). In only 22% of cases, we will observe a typical triad of abdominal bruit, postprandial pain, and body mass reduction (Wu and Nanjundappa, 2024). We can additionally find symptoms of peripheral vascular disease on examination, such as reduced peripheral pulse or symptoms of angina pectoris (Mahajan et al., 2023). Significant malnutrition is also visible (Mahajan et al., 2023). In both types

of ischemia, there is a disproportion between the severity of symptoms and the physical examination that is usually relevant (Mahajan et al., 2023). Table 1 shows feature characterizing chronic and acute mesenteric ischemia.

Table 1 Features characterizing chronic and acute mesenteric ischemia.

Characteristics	CMI	AMI
Onset	Gradual	Acute
Abdominal pain	Severe, postprandial	Sudden, severe, and constant
Physical examination	Weight loss, malnutrition, cachexia Correct, "out of proportion" to pain result of abdominal examination Bruit in abdominal auscultation	Correct "out of proportion" to pain result of abdominal examination Possible symptoms of peritonitis and multiorgan failure in advanced ischemia
Additional characteristics	Food fear History and symptoms of vascular comorbidities	CMI features in the medical history (acute-on-chronic mesenteric ischemia syndrome) Cardiac arrhythmias
First-choice diagnostic test	Computed tomography angiography	Computed tomography angiography

Diagnosis

Computed tomography angiography (CTA) is the first study of choice for MI, as recommended by the Society for Vascular Surgery, American College of Radiology, and European Society of Vascular Surgery (Wu and Nanjundappa, 2024). It can be used for both the diagnosis and the planning of revascularisation procedures (Mahajan et al., 2023; Audu et al., 2023). It gives a 93 % sensitivity and 96% specificity, enabling visualisation of great vessels and bowels perfusion (Audu et al., 2023). Other imaging methods like duplex ultrasonography, which has a sensitivity and specificity of up to 90% in advanced stenosis, magnetic resonance angiography, or contrast angiography, may also be beneficial (Audu et al., 2023; Wu and Nanjundappa, 2024).

No laboratory test can help us establish the diagnosis of CMI (Mahajan et al., 2023). Leukocytosis, acidosis, and elevated lactate may be helpful in the diagnosis of AMI, but their normal range does not exclude the diagnosis (Audu et al., 2023). Despite the availability of effective tests, mesenteric ischemia often goes unrecognized or is diagnosed late, with a significant impact on patient prognosis (Audu et al., 2023). It is for this reason that we need to keep CMI in mind as a differential diagnosis in patients who suffer from chronic abdominal pain (Audu et al., 2023).

Treatment

Treatment is primarily surgical, and the relief of symptoms is immediate (Mahajan et al., 2023). At least 88% of patients achieve a good treatment outcome (Audu et al., 2023). Revascularisation can be performed using different techniques: Endovascular, open, or hybrid (Audu et al., 2023). The choice of technique depends on the type of ischemia. Open treatment (OT) is preferred for AMI, which may require bowel resection (Audu et al., 2023). Endovascular treatment (ET) is characterized by a lower risk of complications during hospitalization (Cai et al., 2015).

However, ET presents a higher risk of recurrence within 3 years than open surgery (Cai et al., 2015; Goto et al., 2024). Mortality and 3-year overall survival rates are comparable for both techniques (Cai et al., 2015). ET should be selected as the first choice, especially in cachexic patients with CMI. OT, according to better outcomes in the long run, should be performed in younger patients or when someone is disqualified from ET (Pecoraro et al., 2013). To maintain effects, we need to treat hyperlipidemia and modify other risk factors (Mahajan et al., 2023). Quitting smoking by a patient is crucial to delay the progression of atherosclerosis (Mahajan et al., 2023).

4. CONCLUSION

Mesenteric ischemia is a rare condition resulting from insufficient blood flow through the visceral arteries, which can be chronic or acute. Chronic ischemia is most often caused by atherosclerosis, leading to narrowing or occlusion of the arteries, with symptoms occurring mainly after meals, such as abdominal pain and weight loss. Acute ischemia is most often due to an embolism or thrombus, leading to serious complications such as intestinal necrosis or multiple organ failure. The disease mainly affects the elderly, especially women, and is associated with a high mortality rate. Mesenteric ischemia is a challenging issue for clinicians due to its unspecific presentation and rare occurrence.

Early diagnosis is crucial, as delayed diagnosis reduces the chances of survival, especially in AMI. Diagnosis is based on CT angiography. Primary treatment is surgical recanalization of the vessels. The choice of technique depends on the type of ischemia and the clinical stage of the patient. Endovascular treatment is less invasive but may be associated with a higher risk of recurrence, while open surgery offers superior long-term results. Controlling risk factors, such as hyperlipidemia and smoking cessation, is also an essential part of treatment. Increased awareness of the disease, and therefore early diagnosis and treatment, is key to improving prognosis and reducing mortality.

Authors' Contribution

Aleksandra Jonkisz: Conceptualization, writing- rough preparation, investigation
Seweryn Rozalczyk: Formal analysis, methodology, supervision
Gabriela Skurzyńska: Visualization, supervision
Zuzanna Bałoniak: Methodology, data curation
Agnieszka Leszyńska: Conceptualization, project administration
Julia Bałoniak: Conceptualization, methodology
Michalina Doligalska: Conceptualization, writing- rough preparation
Aleksandra Stremel: Resources, writing- rough preparation
Aleksandra Anioła: Resources, data curation
Sandra Ważniewicz: Writing - review and editing, supervision
All authors have read and agreed to the published version of the manuscript.

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Ethical approval

Not applicable.

Informed consent

Not applicable.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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