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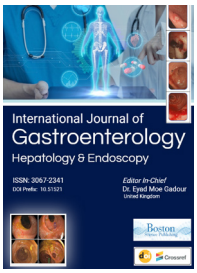

Advanced Approaches in the Treatment of Acute Abdomen: A Systematic Review

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ABSTRACT

Introduction: Acute abdomen is a medical emergency that requires rapid diagnosis and effective intervention to reduce morbidity and mortality. With technological advances, new minimally invasive approaches and endovascular procedures have been explored to optimise the treatment of these conditions. This study presents a systematic review of advanced strategies used in the management of acute abdominal conditions, analysing their efficacy and clinical impact.

Methodology: Strict inclusion and exclusion criteria were followed to select relevant studies published in the main scientific databases, such as PubMed, Scielo and Cochrane Library. Clinical trials, observational studies and previous systematic reviews evaluating modern approaches, including laparoscopy, arterial embolisation, endovascular thrombolysis and angioplasty with stents, were analyzed.

Results: They demonstrate that minimally invasive techniques, such as laparoscopy and endovascular procedures, significantly reduce complications, length of hospital stay and need for postoperative analgesia. Endovascular thrombolysis and angioplasty with stents have proven effective in the treatment of acute vascular abdomen, improving patient survival and reducing the need for bowel resection. In addition, the use of arterial embolisation has been essential in the management of intra-abdominal haemorrhages, avoiding more aggressive open surgeries.

Discussion: Innovation in the diagnosis and treatment of acute abdomen is important. Technological advances and the integration of multidisciplinary teams allow for more accurate and safe management, minimising risks and improving patient recovery. Despite the benefits, challenges remain, such as the need for better strategies for hemorrhagic acute abdomen and the identification of biomarkers that can predict clinical outcomes. Artificial intelligence and clinical decision support systems emerge as promising tools to improve treatment personalisation.

Conclusion: Advanced approaches in the treatment of acute abdomen demonstrate a positive impact on clinical practice, providing better patient outcomes and reducing morbidity associated with invasive procedures. The evolution of medical techniques has allowed for more efficient and safe management, promoting significant advances in the care of patients with this condition.

INTRODUCTION

Acute abdomen (AA) is a medical condition characterised by sudden, intense abdominal pain that may indicate an emergency and require immediate intervention (Dias, Rozario, & Olakkengil, 2015). This term does not refer to a specific disease, but rather to a set of symptoms that may be associated with various pathologies that affect the abdominal organs. The pain may arise without warning and, in most cases, is related to inflammatory, obstructive, perforative, vascular, or hemorrhagic processes (Brewer et al., 1976).

The main characteristic of AA is the sudden onset of abdominal pain, which may vary in intensity and location. In some cases, the pain may be diffuse, while in others it may be concentrated in a specific region of the abdomen. In addition to pain, other symptoms may be present, such as nausea, vomiting, fever, abdominal distension, and changes in blood pressure (Bokemeyer, Ochs, & Fuhrmann, 2020).

The diagnosis of AA must be performed quickly to identify its cause and determine the appropriate treatment. The evaluation includes a detailed

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history, physical examination and complementary tests, such as ultrasound (US), computed tomography (CT) and laboratory tests. The diagnostic approach is essential to differentiate possible causes and avoid serious complications (Bokemeyer, Ochs, & Fuhrmann, 2020).

The treatment of AA depends on the underlying condition. In cases of infection, antibiotics may be administered; in situations of intestinal obstruction, surgical intervention may be necessary; and in cases of organ perforation, emergency surgery is often indicated. Intensive support may also be necessary to stabilise patients in critical condition (Coccolini et al., 2021).

As it is a potentially serious condition, AA requires immediate medical attention. Early recognition of symptoms and seeking specialised care are essential to ensure an accurate diagnosis and effective treatment, reducing risks and improving the patient's prognosis (Coccolini et al., 2021).

The incidence of AA varies according to the underlying cause and the population studied. In Brazil, it is estimated that acute abdominal pain is responsible for 5 to 10% of emergency room admissions. In the United States, there are approximately 7 million cases per year, while in England, approximately 300,000 cases are recorded annually (Coccolini et al., 2021).

Acute appendicitis, one of the main causes of AA, has an incidence of 48.1 cases per 10,000 inhabitants per year, with a higher prevalence between 10 and 20 years of age (Coccolini et al., 2021).

Although there are data on specific causes of AA, the lack of systematisation and computerisation of health systems makes it difficult to accurately estimate the global incidence. However, it is known that this condition is one of the main reasons for emergency care in several countries. The estimate of new cases of AA varies according to the region and the underlying cause. In Brazil, the lack of systematisation of public and private health data makes it difficult to accurately estimate the number of new annual cases (Hori & SAGES, 2008).

Although there is data on specific causes of AA, the lack of standardised records in many countries makes it difficult to obtain an accurate global estimate. However, it is known that this condition is one of the main reasons for emergency care in several health systems around the world (Hori & SAGES, 2008).

The distribution of AA in Brazil varies according to factors such as age, sex, and geographic region. Between 2008 and 2022, approximately 366,225 hospitalisations related to this condition were recorded. The average hospitalisation rate was higher among males, being 20% higher than the rate observed in women. In addition, the incidence was higher in people aged 60 or over, a group that has shown significant growth in the number of cases over the years (Rogers & Kirton, 2024).

Geographically, some federative units recorded hospitalisation rates above the national average. States such as Pernambuco, Distrito Federal, Rondônia, Acre, Goiás and Mato Grosso had higher rates of hospitalisation due to AA. In the Brazilian Northeast, studies indicate that most cases are related to inflammatory conditions, such as cholecystitis and appendicitis (Rogers & Kirton, 2024).

The epidemiological analysis of AA in Brazil reinforces its clinical relevance and the need for effective strategies for early diagnosis and treatment. Continuous monitoring of cases can contribute to the formulation of health policies aimed at reducing morbidity and mortality associated with this condition (Rogers & Kirton, 2024).

AA can have several etiologies, being caused by inflammatory, obstructive, perforative, vascular or hemorrhagic processes. Each of these categories involves different medical conditions that can lead to severe symptoms and require immediate intervention (Struller et al., 2017).

Inflammatory processes are one of the main causes of AA and include diseases such as appendicitis, cholecystitis, pancreatitis and diverticulitis. These conditions result from an intense inflammatory response, which can lead to severe abdominal pain, fever and signs of infection (Wagner, McKinney, & Carpenter, 1996).

The inflammatory process in AA occurs as a response of the organism to tissue aggression, and can be triggered by infections, injuries, chemical irritation or cellular necrosis. This mechanism involves a series of cellular and molecular events that aim to contain the damage and promote the repair of the affected tissues (Salem, Molloy, & O'Dwyer, 2007).

Initially, there is an inflammatory stimulus, which can be caused by infectious agents, such as bacteria, or by mechanical and chemical injuries. This stimulus activates immune system cells, such as macrophages and mast cells, which release inflammatory mediators, including cytokines (IL-1, IL-6, TNF-α) and chemokines. These substances promote vasodilation and increased vascular permeability, allowing leukocyte migration to the site of inflammation (Rozycki et al., 2002).

The exudative phase of inflammation is characterised by the accumulation of protein-rich fluid and inflammatory cells in the affected tissue. This exudate may contain fibrin, which contributes to the formation of adhesions and can lead to intestinal obstruction in severe cases. In addition, activation of the complement system and the release of free radicals intensify the inflammatory response, which may result in tissue necrosis (Ng, Squires, & Busuttil, 2007).

In cases of acute inflammatory abdomen (AIA), such as appendicitis or cholecystitis, inflammation may progress to peritonitis, a serious condition characterised by the spread of the inflammatory response to the entire peritoneal cavity. This may lead to sepsis, requiring immediate surgical intervention and intensive support (Laméris et al., 2009).

The inflammatory process can be self-limiting or evolve into more serious complications, depending on the cause and the body's response. Treatment involves the use of anti-inflammatories, antibiotics and, in many cases, surgery to remove the inflammatory focus and prevent systemic complications. Early identification and appropriate management are essential to avoid adverse outcomes and ensure the patient's recovery (Gans et al., 2015).

Obstructive causes occur when there is a blockage in the gastrointestinal tract, preventing the normal flow of substances. This can be caused by intestinal adhesions, hernias, tumours or faecal impaction. Obstruction can lead to abdominal distension, vomiting and difficulty in eliminating faeces and gas (Dye, 2003).

Acute obstructive abdomen (AOA) is a medical condition characterised by the partial or complete interruption of intestinal transit, preventing the passage of digestive contents and causing severe symptoms such as severe abdominal pain, distension, nausea and vomiting. This obstruction can be classified as mechanical or functional, depending on the underlying cause (Powers & Guertler, 1995).

Mechanical obstruction occurs when there is a physical blockage in the intestine, preventing the normal flow of intestinal contents. Among the main causes are adhesions, which form after abdominal surgeries and can trap intestinal loops, making it difficult to move. Hernias are also responsible for obstructions, especially when a portion of the intestine becomes trapped and strangulated in an opening in the abdominal wall. Intestinal tumours, such as colon adenocarcinoma, can grow within the intestinal lumen and completely block transit. Other causes include intestinal volvulus, which occurs when the intestine twists on itself, compromising blood flow and causing obstruction, and intussusception, a condition most common in children, in which one part of the intestine invaginates inside another, blocking the passage of contents. Faecal impaction, resulting from the accumulation of hardened faeces and the ingestion of foreign bodies, can also cause obstruction (Rhodes et al., 2017).

Functional obstruction, known as paralytic ileus, occurs when there is a failure in intestinal motility, without the presence of a physical blockage. Hydroelectrolytic disorders, such as hypokalemia, can compromise the muscular activity of the intestine, making it difficult to move. The use of medications such as opioids can reduce intestinal motility and lead to paralytic ileus. Intra-abdominal inflammatory processes, such as peritonitis, can also paralyse intestinal transit, while intestinal ischemia compromises blood circulation to the abdominal organs, affecting their functionality. In septic patients, the systemic inflammatory response can reduce intestinal motility, worsening the clinical picture (Trowbridge, Rutkowski, & Shojania, 2003).

The diagnosis of AOA involves clinical and imaging tests, such as X-ray, ultrasound, and CT, to determine the cause and severity of the obstruction. Treatment may vary depending on the type and severity of the obstruction, including conservative measures, such as hydration and nutritional support, or surgical intervention in more severe cases, especially when there is a risk of bowel necrosis or perforation. Early recognition and appropriate management are essential to avoid complications and ensure a favourable outcome for the patient (Salem, Molloy, & O'Dwyer, 2007).

Perforative cases involve rupture of internal organs, such as perforated gastric ulcers, bowel perforation, or gallbladder rupture. These conditions can result in peritonitis, a severe inflammation of the peritoneum, which can lead to septic shock if not treated promptly (Staniland, Ditchburn, & De Dombal, 1972).

Perforative acute abdomen (PAA) is a serious condition characterised by rupture of hollow viscera of the gastrointestinal tract, such as the stomach, small intestine, and colon. This perforation leads to the leakage of gastrointestinal contents into the peritoneal cavity, resulting in peritonitis, which can progress to sepsis and shock, requiring immediate medical intervention (Grundmann, Petersen, Lippert, & Meyer, 2010).

The main causes of PAA include perforated peptic ulcers, complicated appendicitis, diverticulitis with perforation, Crohn's disease, invasive neoplasms, ingestion of foreign bodies, and complications of medical procedures. Perforation can occur due to chronic inflammatory processes that weaken the intestinal wall, leading to spontaneous rupture or secondary to a sudden increase in intraluminal pressure (Fleischer, Gardner, & Feldman, 2001).

The clinical presentation of patients with PAA usually involves severe, sudden-onset abdominal pain, often described as stabbing or shooting. The pain may be diffuse and rapidly progressive, accompanied by signs of peritoneal irritation, such as abdominal guarding and board-like rigidity. Other symptoms include fever, nausea, vomiting, loss of appetite, and signs of shock, such as hypotension and tachycardia (Halabe-Cherem, 2004).

The diagnosis is based on clinical history, physical examination, and complementary tests. Abdominal X-ray may reveal pneumoperitoneum, indicating the presence of free air in the peritoneal cavity due to perforation. CT is the examination of choice to confirm the location of the perforation and assess the extent of peritonitis (Mayumi et al., 2016).

The treatment of PAA is surgical in most cases. The approach may include exploratory laparotomy or minimally invasive surgery to repair the perforation, drainage of the peritoneal cavity, and removal of the compromised intestinal segment. In addition to surgical intervention, clinical management involves volume replacement, broad-spectrum antibiotic therapy, and intensive support for hemodynamic stabilisation (Mayumi et al., 2016).

Vascular causes are related to circulatory problems, such as mesenteric thrombosis, which reduces blood flow to the abdominal organs, leading to tissue necrosis. This condition can cause severe and sudden pain, as well as severe impairment of bowel function (Mayumi et al., 2016).

Vascular acute abdomen (VAA) is a serious condition caused by changes in blood flow to the abdominal organs, resulting in ischemia and, in more severe cases, tissue necrosis. These changes can occur due to arterial or venous obstruction, compromising tissue perfusion and leading to intense and rapidly evolving symptoms (Manterola, Vial, Moraga, & Astudillo, 2011).

Among the main causes of VAA, mesenteric thrombosis stands out, which occurs when a clot forms within the mesenteric arteries, which are responsible for irrigating the intestine. This blockage reduces the supply of oxygen and nutrients, causing intense and progressive abdominal pain, in addition to compromising intestinal function. Thrombosis can be arterial or venous, with the arterial form being more serious due to the sudden interruption of blood flow (Grundmann, Petersen, Lippert, & Meyer, 2010).

Another important cause is arterial embolism, characterised by the displacement of an embolus – usually a clot originating in the heart – to the mesenteric arteries. This event can occur in patients with atrial fibrillation, valvular heart disease or after surgical procedures. Sudden arterial obstruction leads to intense pain, which can quickly progress to intestinal necrosis if not treated promptly (Saunders et al., 2012).

Abdominal aortic dissection is another vascular condition that can result in AA. In this case, there is a separation of the layers of the aortic wall, compromising blood flow to the abdominal organs. Symptoms include severe abdominal pain that radiates to the back, as well as signs of shock in advanced cases (Khesrani et al., 2020).

Mesenteric venous entrapment syndrome occurs when there is obstruction of venous return, leading to the accumulation of blood in the intestinal vessels and compromising adequate drainage. This can result in oedema, increased intra-abdominal pressure and risk of intestinal necrosis (Khesrani et al., 2020).

The diagnosis of VAA is challenging and requires imaging tests such as CT angiography, Doppler US and laboratory tests to assess vascular function. Treatment depends on the underlying cause and may include thrombolysis, anticoagulation, surgery to remove the clot or revascularisation of the affected segment (Khesrani et al., 2020).

Finally, hemorrhagic causes involve internal bleeding, such as a ruptured abdominal aneurysm or ruptured ectopic pregnancy. These conditions can lead to hypovolemic shock, characterised by a drop in blood pressure and risk of organ failure.

Acute hemorrhagic abdomen (AHA) is a serious condition characterised by internal bleeding into the abdominal cavity, which can result in hypovolemic shock and organ failure if not treated promptly. The causes of haemorrhage can be classified as traumatic, vascular, gynaecological, and gastrointestinal, each with distinct mechanisms of injury and clinical impact (Khesrani et al., 2020).

Among the traumatic causes, injuries resulting from car accidents, falls, and gunshot or stab wounds stand out. Trauma can lead to rupture of solid organs, such as the liver and spleen, causing significant haemorrhage (Khesrani et al., 2020).

Vascular causes include rupture of intra-abdominal arterial aneurysms, such as abdominal aortic aneurysm, which can lead to massive haemorrhage and rapid deterioration of the clinical condition. Furthermore, arteriovenous malformations of the gastrointestinal tract can result in spontaneous and recurrent bleeding (Coccolini et al., 2021).

In the gynaecological context, ruptured ectopic pregnancy is one of the main causes of AHA in women of childbearing age. The rupture of the ectopic pregnancy, usually located in the uterine tube, causes significant internal bleeding and requires emergency intervention. Other conditions, such as hemorrhagic ovarian cysts and severe endometriosis, can also cause intra-abdominal haemorrhage (Coccolini et al., 2021).

Gastrointestinal causes include perforated ulcers, Mallory-Weiss syndrome (laceration of the oesophageal mucosa due to intense vomiting), hemorrhagic diverticula, and aortoduodenal fistulas. These conditions can lead to severe digestive bleeding, requiring rapid diagnosis and appropriate treatment (Coccolini et al., 2021).

The diagnosis of AHA involves clinical, laboratory and imaging tests, such as ultrasound and CT, to identify the source of the bleeding. Treatment may include volume replacement, blood transfusion, use of hemostatic agents and surgical intervention to control bleeding (Bokemeyer, Ochs, & Fuhrmann, 2020).

The first step in the diagnosis of AA involves a detailed anamnesis, in which the physician collects information about the onset of pain, its location, intensity, radiation and factors that may aggravate or alleviate symptoms. In addition, associated symptoms such as fever, nausea, vomiting, changes in bowel habits and signs of shock are investigated. The patient's medical history, including previous surgeries, medication use and pre-existing diseases, is also considered (Bokemeyer, Ochs, & Fuhrmann, 2020).

Physical examination is essential to assess signs of peritoneal irritation, such as abdominal guarding, tenderness on palpation, and muscle rigidity. The presence of abdominal distension, palpable masses, and changes in bowel sounds can provide important clues about the cause of AA. Rectal and gynaecological examinations can also be performed to identify possible urological or gynaecological causes (Coccolini et al., 2021).

After the initial clinical evaluation, laboratory tests are requested, including complete blood count, measurement of inflammatory markers (CRP and leukocytes), electrolytes, and renal and hepatic function. In suspected cases of perforation or bleeding, coagulation tests and lactate measurement may be useful to assess the severity of the condition (Bokemeyer, Ochs, & Fuhrmann, 2020).

Imaging tests play a crucial role in the diagnosis of acute abdomen. Abdominal X-ray may reveal signs of intestinal obstruction, pneumoperitoneum (indicative of perforation), or gallstones. Ultrasound is widely used to assess conditions such as cholecystitis, appendicitis, and ectopic pregnancy. CT is considered the examination of choice for more complex cases, allowing a detailed assessment of the abdominal anatomy and identification of inflammatory, obstructive, or vascular processes (Bokemeyer, Ochs, & Fuhrmann, 2020).

In specific situations, additional examinations may be necessary, such as magnetic resonance imaging, angiography to assess intestinal ischemia, and diagnostic laparoscopy in cases that are difficult to define clinically. The speed in performing these examinations is essential to avoid serious complications and ensure effective treatment (Rogers & Kirton, 2024).

Initially, the management of AA involves clinical support measures, such as volume replacement for hemodynamic stabilisation, pain control with analgesics, and administration of antibiotics in cases of infection. Patients with signs of shock or sepsis may require intensive support, including monitoring in an intensive care unit (Rogers & Kirton, 2024).

In cases of AIA, such as appendicitis and cholecystitis, treatment may include antibiotic therapy and surgery to remove the affected organ. The laparoscopic approach is often used, as it reduces recovery time and minimises postoperative complications (Rogers & Kirton, 2024).

AOA may require conservative measures, such as hydration and intestinal decompression by nasogastric tube, or surgical intervention to remove the obstructing factor, such as bands, tumours or incarcerated hernias (Coccolini et al., 2021).

In situations of PAA, such as perforated gastric ulcer or intestinal perforation, emergency surgery is necessary to repair the injury and prevent the spread of infection to the peritoneal cavity. Peritoneal lavage and drainage of abscesses may be performed to reduce the risk of sepsis (Coccolini et al., 2021).

VAA, caused by mesenteric thrombosis or arterial embolism, may require anticoagulation, thrombolysis, or surgery to revascularize the compromised intestinal segment. Rapid intervention is essential to prevent intestinal necrosis and organ failure (Coccolini et al., 2021).

AHA, resulting from a ruptured aneurysm or ruptured ectopic pregnancy, requires immediate control of bleeding, which may involve blood transfusion and surgery to correct the vascular injury (Bokemeyer, Ochs, & Fuhrmann, 2020).

The treatment of AA has evolved significantly with advances in medical and surgical techniques, allowing for more effective and less invasive approaches. The choice of treatment depends on the underlying cause and may involve conservative measures, minimally invasive procedures, or emergency surgery (Bokemeyer, Ochs, & Fuhrmann, 2020).

In cases of AIA, laparoscopy remains the preferred technique, providing shorter recovery time and fewer postoperative complications. In addition, the use of broad-spectrum antibiotics has been improved to reduce the need for surgery in some cases of uncomplicated appendicitis (Bokemeyer, Ochs, & Fuhrmann, 2020).

Initially, the patient receives clinical support to stabilise the condition. This includes fluid replacement to correct dehydration and maintain organ perfusion, pain control with analgesics and anti-inflammatories, and antibiotic therapy to combat associated bacterial infections. Clinical monitoring is essential to identify signs of worsening, such as persistent fever, tachycardia, and hypotension (Bokemeyer, Ochs, & Fuhrmann, 2020).

Treatment varies according to the inflammatory disease present. In acute appendicitis, appendectomy is performed, usually by laparoscopy, providing faster recovery and fewer complications. Acute cholecystitis, which affects the gallbladder, is treated by cholecystectomy, which is the preferred minimally invasive approach. Acute pancreatitis, which can be caused by gallstones or excessive alcohol consumption, requires intensive clinical support, with aggressive hydration and pain control. In cases of acute diverticulitis, antibiotic therapy may be sufficient for mild cases, but surgery is necessary in complicated situations, such as perforation or abscess (Trowbridge, Rutkowski, & Shojania, 2003).

In more severe cases, where there is a risk of peritonitis or sepsis, surgical intervention must be performed urgently to remove the inflammatory focus and avoid systemic complications. Minimally invasive techniques, such as laparoscopy and percutaneous drainage, have been widely used to reduce hospital stay and improve prognosis (Trowbridge, Rutkowski, & Shojania, 2003).

After treatment, the patient must be monitored to avoid relapses and ensure adequate recovery. Nutritional rehabilitation, use of probiotics to restore intestinal microbiota, and medical follow-up are important to prevent new episodes (Trowbridge, Rutkowski, & Shojania, 2003).

For AOA, new bowel decompression techniques, such as therapeutic endoscopy, have been used to remove obstructions without the need for open surgery. In cases of obstruction by tumours, the placement of intestinal stents can restore intestinal flow and avoid more aggressive procedures (Coccolini et al., 2021).

Initially, the patient receives clinical support, including hydration to correct electrolyte imbalances and maintain organ perfusion, in addition to pain control with analgesics and anti-inflammatories. If there is suspicion of an associated bacterial infection, broad-spectrum antibiotics are administered to prevent the spread of the inflammatory process. Continuous monitoring is essential to detect signs of worsening, such as persistent fever, tachycardia or hypotension (Coccolini et al., 2021).

If the cause of AIA is acute appendicitis, the standard treatment is removal of the appendix, usually performed by laparoscopy, a technique that reduces recovery time and minimises postoperative complications. In the case of cholecystitis, surgery to remove the gallbladder is indicated, preferably performed by a minimally invasive approach. Acute pancreatitis is treated with supportive measures, such as aggressive hydration and pain control, and avoiding oral feeding until the condition is stabilised. For patients with diverticulitis, antibiotics are administered in mild cases, while those with abscesses or perforation may require surgery to remove the affected intestinal segment (Coccolini et al., 2021).

In more severe cases, where there is a risk of peritonitis or sepsis, surgical intervention should be immediate to remove the inflammatory focus and prevent systemic complications. Minimally invasive techniques, such as percutaneous abscess drainage and laparoscopic surgery, are preferred to reduce morbidity and accelerate recovery (Coccolini et al., 2021).

After treatment, the patient needs medical follow-up to avoid relapses. Recovery may include dietary adjustments, use of probiotics to restore the intestinal microbiota, and clinical reassessments to monitor digestive health (Bokemeyer, Ochs, & Fuhrmann, 2020; Coccolini et al., 2021).

In PAA, minimally invasive surgery has been increasingly used to repair perforations and perform peritoneal drainage. The use of laparoscopic suturing techniques and video-guided peritoneal lavage has improved clinical outcomes, reducing the risk of generalised infection (Bokemeyer, Ochs, & Fuhrmann, 2020; Coccolini et al., 2021).

The first step in the management of PAA is patient stabilisation, which includes fluid replacement to correct dehydration and maintain organ perfusion, in addition to the administration of broad-spectrum antibiotics to reduce the risk of infection. Pain control is achieved with analgesics, and in many cases, intensive support may be necessary for critically ill patients (Bokemeyer, Ochs, & Fuhrmann, 2020; Coccolini et al., 2021).

The diagnosis is confirmed by imaging tests, and an abdominal X-ray may reveal pneumoperitoneum, indicating the presence of air in the peritoneal cavity, one of the most common signs of perforation. Definitive treatment involves surgery to repair the perforation and remove necrotic tissue. In many cases, a minimally invasive approach, such as laparoscopy, can be used to shorten recovery time and reduce postoperative complications. During the procedure, peritoneal lavage is performed to remove contaminated material and prevent secondary infections. In addition, drainage of fluid collections or abscesses may be necessary to ensure the patient's recovery (Bokemeyer, Ochs, & Fuhrmann, 2020; Coccolini et al., 2021).

After surgery, the patient must be monitored continuously for signs of sepsis, organ failure, or other complications. Recovery involves adequate nutritional support, which may include parenteral nutrition in cases where oral feeding is not feasible. Clinical follow-up is essential to ensure adequate healing and prevent new episodes of perforation (Bokemeyer, Ochs, & Fuhrmann, 2020; Coccolini et al., 2021).

Early identification and rapid intervention are essential to improve patient prognosis and reduce mortality associated with PAA.

PAA has benefited from advances in endovascular thrombolysis, allowing clot dissolution without the need for open surgery. In addition, angioplasty with stents has been used to restore blood flow in cases of intestinal ischemia. The first step in the management of PAA is hemodynamic stabilisation of the patient. This includes fluid replacement to correct hypotension and maintain organ perfusion, in addition to the administration of anticoagulants to prevent progression of thrombosis. In cases of shock, intensive support with vasoactive drugs may be necessary to stabilise circulation (Bokemeyer, Ochs, & Fuhrmann, 2020; Coccolini et al., 2021).

The diagnosis is confirmed by imaging tests, such as CT angiography, which allows detailed visualisation of the mesenteric vessels and identification of arterial or venous obstructions. Angiography can be used to guide therapeutic procedures, such as thrombolysis or angioplasty. Definitive treatment depends on the underlying cause. In cases of mesenteric thrombosis, endovascular thrombolysis can be performed to dissolve the clot and restore blood flow. In more severe situations, revascularisation surgery may be necessary to remove the thrombus and preserve intestinal viability. When there is intestinal necrosis, resection of the affected segment is indicated (Bokemeyer, Ochs, & Fuhrmann, 2020; Coccolini et al., 2021).

Mesenteric thrombosis is one of the main causes of VAA, characterised by the formation of a clot in the blood vessels that supply the intestine, leading to reduced or interrupted blood flow. This condition can result in intestinal ischemia, tissue necrosis, and, if not treated quickly, can progress to sepsis and organ failure. Thrombosis can affect both the superior mesenteric artery and the mesenteric vein, and is more common in patients with risk factors such as atherosclerosis, atrial fibrillation, hypercoagulability, inflammatory bowel disease and a history of deep vein thrombosis. The interruption of blood flow provokes an intense inflammatory response, leading to the release of inflammatory mediators and compromising the integrity of the intestinal mucosa (Laméris et al., 2009).

Symptoms of mesenteric thrombosis include severe abdominal pain disproportionate to clinical findings, nausea, vomiting, abdominal distension and, in advanced stages, signs of shock. Diagnosis is challenging and requires imaging tests such as angiotomography, which allows visualisation of the mesenteric vessels and identification of the obstruction. Treatment may be medical or surgical, depending on the extent of the thrombosis and intestinal viability. In early cases, anticoagulation and endovascular thrombolysis may be chosen to dissolve the clot and restore blood flow. In more severe cases, where there is intestinal necrosis, surgical resection of the affected segment may be necessary (Laméris et al., 2009).

In arterial embolism, the approach may include surgical embolectomy or pharmacological thrombolysis to remove the embolus and reestablish circulation. In patients with abdominal aortic dissection, vascular endoprosthesis placement may be performed to stabilise the arterial wall and prevent rupture (Laméris et al., 2009).

Arterial embolism in AA occurs when an embolus – usually a blood clot originating in the heart – dislodges and obstructs one of the main arteries supplying the gastrointestinal tract, such as the superior mesenteric artery. This sudden obstruction compromises blood flow to the intestine, leading to intestinal ischemia, tissue necrosis and, if not treated quickly, can progress to sepsis and organ failure. The main risk factors for arterial embolism include atrial fibrillation, valvular heart disease, myocardial infarction and deep vein thrombosis. The interruption of blood flow provokes an intense inflammatory response, leading to the release of inflammatory mediators and compromising the integrity of the intestinal mucosa (Laméris et al., 2009).

Symptoms of arterial embolism include sudden, severe abdominal pain, usually disproportionate to clinical findings, as well as nausea, vomiting, and signs of shock. Diagnosis is challenging and requires tests such as CT angiography. Treatment may be clinical or surgical, depending on the extent of the embolism and intestinal viability. In early cases, endovascular thrombolysis may be chosen to dissolve the embolus and restore blood flow. In more severe cases, where there is intestinal necrosis, embolectomy surgery and resection of the affected segment may be necessary (Mayumi et al., 2016).

In cases of splanchnic vasoconstriction, caused by septic shock or circulatory failure, treatment involves hemodynamic support and the use of vasodilators to improve perfusion of the abdominal organs. It occurs when there is a significant reduction in blood flow to the abdominal organs due to contraction of the splanchnic vessels. This condition can result in non-occlusive mesenteric ischemia, compromising intestinal perfusion and leading to tissue necrosis if not treated quickly (Mayumi et al., 2016).

Splanchnic vasoconstriction can be triggered by circulatory shock, use of vasopressors, severe heart failure, and low blood output states. In septic shock, redistribution of blood flow prioritises vital organs such as the brain and heart, reducing irrigation of the gastrointestinal tract and increasing the risk of ischemia. In addition to diffuse and progressive abdominal pain, nausea, vomiting, and signs of hypoperfusion, such as cold extremities and hypotension, are common findings. Diagnosis is challenging, as there is no evident obstruction of the mesenteric vessels. Tests such as angiotomography and vascular Doppler can help assess intestinal perfusion and rule out occlusive causes (Mayumi et al., 2016).

Treatment involves correction of the underlying cause, such as hemodynamic stabilisation and adjustment of vasopressor therapy. In some cases, the use of vasodilators may be indicated to improve splanchnic perfusion. Intensive support is essential to avoid serious complications, such as intestinal necrosis and sepsis (Mayumi et al., 2016).

After the intervention, the patient must be monitored to avoid complications such as organ failure and recurrence of ischemia. Clinical follow-up includes adjustments in anticoagulant therapy, nutritional support, and rehabilitation to ensure adequate recovery (Coccolini et al., 2021; Mayumi et al., 2016).

In AHA, image-guided arterial embolisation techniques have been used to control bleeding without the need for invasive surgery. In cases of aneurysm rupture, the endovascular approach with endoprosthesis has replaced open procedures, reducing hospital stay and recovery time (Coccolini et al., 2021; Mayumi et al., 2016).

Advances in medical technologies have allowed more precise and less invasive treatment for AA, improving clinical outcomes and reducing complications. The integration of minimally invasive techniques, endovascular therapies, and improved intensive care support protocols has been instrumental in optimising the management of this condition (Coccolini et al., 2021; Mayumi et al., 2016).

Methodology

The objective was to critically analyse the available scientific evidence, identifying the most effective and innovative strategies for managing this condition. The review sought to gather and synthesise data from clinical studies, evaluating the safety, efficacy, and applicability of different techniques and therapeutic protocols. In addition, the review aimed to identify gaps in the medical literature, suggesting areas that require further research. Search databases such as PubMed, Embase, Scielo, and the Cochrane Library were used. The selection of articles underwent a two-stage screening process. Initially, titles and abstracts were analysed to verify the relevance of the studies found. Then, the selected articles were read in full to confirm whether they met the established criteria. After this stage, data extraction occurred, where relevant information was collected from the articles, such as patient characteristics, interventions performed, study methodology, and clinical outcomes. The inclusion criteria were: types of study where research was included, such as randomised clinical trials, observational studies, and previous systematic reviews that evaluated AA treatment methods. These types of research provide robust evidence on the efficacy, safety, and impact of the therapeutic approaches used. The population studied is another essential criterion. The review included studies involving patients diagnosed with different forms of AA, such as inflammatory, obstructive, perforative, vascular, and hemorrhagic. Interventions analysed were articles that evaluated clinical, surgical, and minimally invasive treatments were selected. The objective was to gather information on innovative procedures, pharmacological therapies, and technological advances applied to the management of AA and, about the clinical outcome, aspects such as treatment efficacy, complication rates, recovery time, and mortality were considered to assess the real impact of the approaches studied, helping to define best medical practices. The period analysed was from 2015 to 2025 to ensure the evidence was analysed. The articles analysed could not be in any language other than Portuguese, English, or Spanish, in addition to having access to the full text.

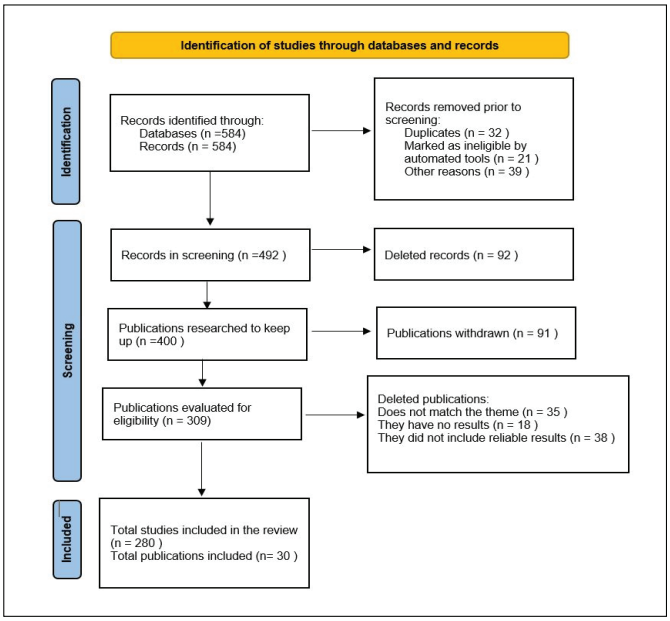
Results

The results demonstrate significant advances in the treatment of AA, with an emphasis on minimally invasive approaches that provide better clinical outcomes. Laparoscopy, widely used in the management of conditions such as appendicitis, cholecystitis and intestinal obstruction, has proven to be highly effective, reducing hospital stays and postoperative complications and accelerating patient recovery. In addition to its superior diagnostic accuracy compared to traditional methods such as CT and US, the technique allows for less traumatic intervention and avoids unnecessary open surgeries.

Another highlight was the use of image-guided arterial embolisation to control intra-abdominal haemorrhages, eliminating the need for invasive surgical procedures. In cases of VAA, endovascular thrombolysis and angioplasty with stents have proven to be safe and effective alternatives for restoring blood flow in patients with mesenteric thrombosis or arterial embolism, reducing the need for intestinal resection and improving patient survival.

There is a need for more effective strategies for the management of AHA and the search for biomarkers capable of predicting clinical outcomes. The application of artificial intelligence and clinical decision support systems emerges as a promising perspective to improve early detection and treatment personalisation, making interventions more precise and effective.

Prisma Flowchart



Discussion

Minimally invasive approaches such as laparoscopy and endovascular procedures have demonstrated lower complication rates, shorter hospital stays, and faster recovery compared to traditional open surgeries. These approaches have revolutionised the treatment of AA, providing significant benefits compared to traditional surgical techniques. Laparoscopy has been widely used for the diagnosis and management of several abdominal conditions, including appendicitis, cholecystitis, intestinal obstruction, and perforation of viscera. Studies indicate that the diagnostic accuracy of laparoscopy ranges from 90% to 100%, making it a highly effective tool for intra-abdominal evaluation. One of the main benefits of these techniques is the reduction in morbidity and mortality associated with open surgeries. Laparoscopy allows for a less traumatic approach, with less tissue manipulation and a lower risk of postoperative infection. Furthermore, patients undergoing minimally invasive procedures have a shorter hospital stay, faster recovery, and less need for postoperative analgesia (Coccolini et al., 2021).

Another relevant aspect is the diagnostic accuracy of laparoscopy, which surpasses traditional methods such as CT and US in certain cases. The ability to directly visualise the peritoneal cavity allows for a more detailed evaluation and avoids unnecessary exploratory laparotomies. This is especially useful in patients with abdominal pain of unknown cause, where laparoscopy can clarify the diagnosis and direct appropriate treatment. In addition to laparoscopy, image-guided arterial embolisation has been used to manage intra-abdominal haemorrhage. This procedure allows bleeding control without the need for open surgery, reducing complications and improving patient prognosis (Khesrani et al., 2020).

Despite the numerous benefits, minimally invasive approaches have some limitations, such as difficulty in accessing retroperitoneal structures and the need for specialised equipment.

In cases of VAA, studies indicate that endovascular thrombolysis and stent angioplasty are safe and effective alternatives to restore blood flow in patients with mesenteric thrombosis or arterial embolism. These strategies have reduced the need for bowel resection and improved patient survival (Bokemeyer, Ochs, & Fuhrmann, 2020).

Endovascular thrombolysis and stent angioplasty are advanced techniques used in the treatment of vascular obstructions, including cases of VAA caused by mesenteric thrombosis or arterial embolism. These minimally invasive approaches allow the restoration of blood flow without the need for open surgery, reducing complications and improving patient prognosis (Bokemeyer, Ochs, & Fuhrmann, 2020).

Endovascular thrombolysis consists of administering thrombolytic agents directly into the obstructed vessel through a catheter. This procedure is performed in stages and may involve daily sessions over a few days. The goal is to dissolve the clot and restore blood circulation, preventing the progression of intestinal ischemia. In some cases, thrombolysis can be combined with mechanical thrombectomy, which uses devices to physically remove the thrombus. Angioplasty with stents is indicated when there is a need for revascularisation of the affected segment. The procedure involves the insertion of an angioplasty balloon, which is inflated to expand the vessel and restore blood flow. A vascular stent is then placed to keep the artery open and prevent further obstructions. This technique is especially useful in cases of chronic arterial thrombosis or significant stenosis (Rogers & Kirton, 2024).

Both approaches are guided by digital angiography, allowing precise visualisation of the affected area and ensuring greater safety in performing the procedure. In addition, the recovery of patients undergoing thrombolysis or angioplasty is generally faster than in conventional surgeries, with shorter hospital stays and lower risk of postoperative complications (Rogers & Kirton, 2024).

About PAA, early identification of perforation and performance of laparoscopy-guided peritoneal lavages have a significant impact on reducing morbidity and mortality. Rapid intervention reduces the risk of sepsis and improves patient prognosis (Rogers & Kirton, 2024).

Persistent challenges have been identified, such as the need for better strategies for the management of PAA and the search for new biomarkers that can predict clinical outcomes. The integration of artificial intelligence and clinical decision support systems is a promising prospect for improving early detection and personalisation of treatment (Rogers & Kirton, 2024).

Conclusion

In conclusion, advances in the treatment of AA reinforce the importance of innovation and the application of new technologies in the constant improvement of the diagnosis and treatment of AA. The evolution of therapeutic approaches has allowed for safer and more effective management, providing better results for patients and contributing to the improvement of medical practice.

Abreviations

AA - Acute Abdomen, **AHA -** Acute Hemorrhagic Abdomen, **AIA -** Acute Inflammatory Abdomen, **AOA -** Acute Obstructive Abdomen, **PAA -** Acute Perforative Abdomen, **VAA -** Acute Vascular Abdomen, **RX -** X-ray, **CT -** Computed Tomography, **US -** Ultrasound.

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