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ASCITES IN GASTROINTESTINAL CANCERS: A REVIEW OF SYMPTOMATIC TREATMENT METHODS AND THEIR EFFECTIVENESS

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ABSTRACT

Introduction: Malignant Ascites (MA) is a serious complication of gastrointestinal cancers that significantly reduces quality of life and is associated with a poor prognosis. Its pathophysiology involves several mechanisms, including increased vascular permeability, venous compression, and lymphatic vessel infiltration.
Material and methods: A literature review was conducted using the PubMed database, covering the years 2017–2025. Search phrases such as "malignant ascites" and "symptomatic treatment of ascites" were used. The review included clinical and review studies focusing on patients with MA associated with gastrointestinal cancers. Studies on ascites of other etiologies and preclinical research were excluded.
Results: The most commonly used symptomatic treatment methods include paracentesis, diuretic therapy, peritoneovenous shunts, indwelling catheters, and intraperitoneal chemotherapy. Each method has its own advantages and limitations. Modern techniques such as HIPEC, immunotherapy, and photothermal therapy show promising results in preliminary studies.
Conclusion: Malignant ascites requires an individualized therapeutic approach. It is essential to combine treatment efficacy with improvements in patients' quality of life. Further research is needed to develop optimal strategies for symptomatic management.

KEYWORDS

Ascites, Treatment Methods, Cancers

CITATION

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1. Introduction

Malignant ascites (MA) is a condition characterized by inflammation and results from the pathological accumulation of fluid in the abdominal cavity due to the presence of a malignant tumor. It accounts for approximately 10% of all cases of ascites [1]. It commonly occurs in patients with terminal-stage intra-abdominal cancers, but also in those with abdominal metastases originating from malignancies located outside the abdominal cavity. Statistically, the incidence is estimated at 37% in ovarian cancer, 21% in cancers of the liver, biliary tract, and pancreas, and 18% in gastric cancer [2]. Malignant ascites consists of a mixture of cellular and non-cellular components that together create a pro-inflammatory microenvironment conducive to tumor progression. It serves as a basis for analyzing the influence of both tumor-related and systemic factors on mechanisms leading to cancer cachexia [3]. The cellular components include cancer cells, immune cells, fibroblasts, adipocytes, mesothelial cells, and extracellular vesicles, while the non-cellular components include cytokines, growth factors, and lipid mediators [4]. As a comorbid condition, MA negatively affects patients' quality of life, as it is frequently accompanied by symptoms such as dyspnea, abdominal tenderness and pain, nausea, loss of appetite, fatigue, and difficulty moving [5]. The occurrence of malignant ascites is associated with a poor prognosis, with median survival time after its onset varying depending on tumor type—from several weeks to a few months. The aim of this paper is to review and analyze the available symptomatic treatment methods for ascites in patients with gastrointestinal cancers. It includes an assessment of the mechanisms underlying ascites formation in the context of cancer progression and a comparison of the efficacy and limitations of various therapeutic strategies.

2. Research materials and methods

To conduct a literature review on the symptomatic treatment of ascites in the course of gastrointestinal cancers, the PubMed database was used. The analysis covered publications from the years 2017 to 2025. The following English search phrases were used: "malignant ascites," "ascites in gastrointestinal cancer," "symptomatic treatment of ascites," "paracentesis in cancer," and "gastrointestinal malignancies and ascites." The review included original articles, review papers, and meta-analyses. Inclusion criteria were: studies involving patients with malignant ascites associated with gastrointestinal cancers, analysis of the effectiveness of symptomatic treatments, and availability of the full text in English. Exclusion criteria included: studies on ascites of non-cancer-related etiology, animal studies, and non-peer-reviewed publications (e.g., commentaries, conference abstracts).

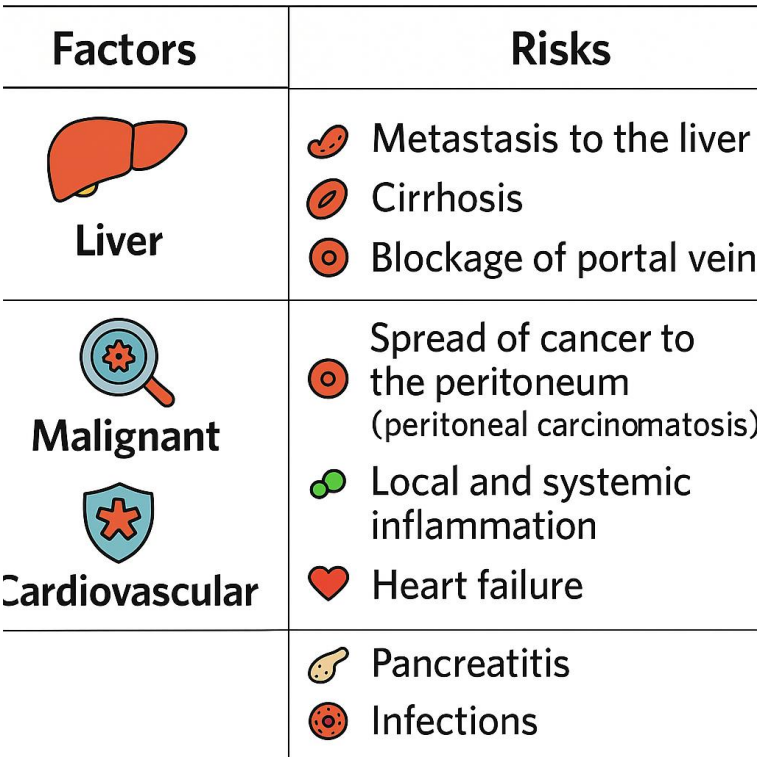

Fig 1. *Risk factors for the development of ascites*

Pathophysiology of malignant ascites formation

The mechanisms underlying the development of malignant ascites are more complex than those seen in cirrhotic ascites, where elevated capillary pressure and decreased plasma protein levels are the predominant factors [6]. The pathophysiology of malignant ascites results from multiple mechanisms, the most critical of which is increased vascular permeability within the tumor environment. This leads to excessive production and accumulation of fluid in the peritoneal cavity. Studies across various cancer types have shown that intense neovascularization of the peritoneum and the secretion of glycoproteins significantly increase the permeability of small blood vessels, thus promoting ascites formation. A key factor in this process is vascular endothelial growth factor (VEGF), which increases capillary permeability and contributes to fluid accumulation in the peritoneal cavity [7]. VEGF also promotes uncontrolled angiogenesis within tumors. Elevated VEGF levels are frequently observed in malignant ascites, particularly in patients with gastric, colorectal, and ovarian cancers, as confirmed by numerous review studies [8]. VEGF binds to the vascular permeability factor (VPF) receptor, which then activates the tyrosine kinase signaling pathway. This explains why blocking this interaction holds therapeutic potential. Another important aspect is that as intra-abdominal tumors progress, they may exert mechanical pressure on the portal vein and inferior vena cava, impeding venous blood flow and favoring fluid accumulation in the peritoneal cavity. Moreover, cancer cells can infiltrate and obstruct lymphatic vessels, disrupting normal lymphatic drainage. Hypoalbuminemia is also commonly observed, leading to a reduction in plasma oncotic pressure. The resulting decrease in circulating blood volume, combined with activation of the renin-angiotensin-aldosterone system, limits urinary excretion and causes water and sodium retention, further exacerbating ascites formation [9].

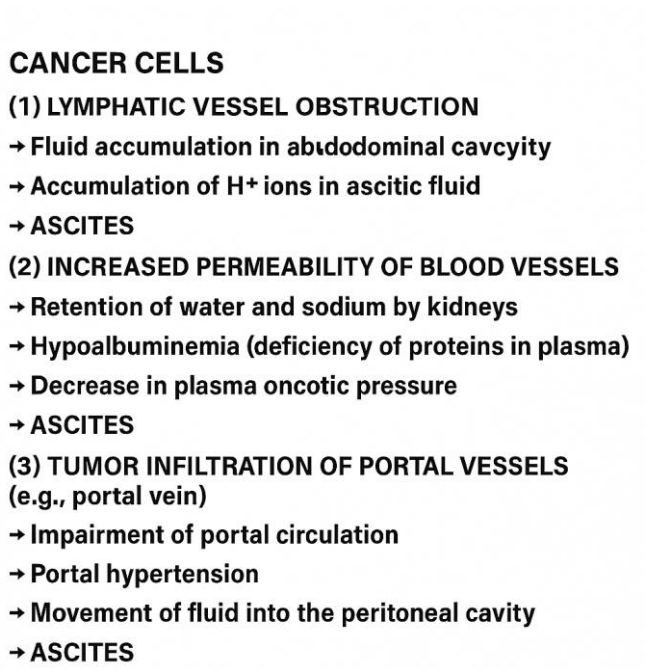

Fig 2. *Pathophysiology of ascites*

Treatment methods

The primary method for treating malignant ascites (MA) is therapy targeting the underlying disease. Unfortunately, in advanced malignancies—especially in the terminal stage—this approach is usually not feasible. Therefore, the focus shifts to palliative treatment. This review highlights five of the most commonly used treatment strategies: paracentesis, diuretic therapy, peritoneovenous shunting, long-term catheter placement, and intraperitoneal chemotherapy. In recent years, with advances in cancer research, new treatment options have emerged in photothermal therapy, intestinal therapy, and immunotherapy. These approaches offer new hope for patients with refractory ascites in whom standard treatments have failed, potentially reducing symptoms and improving quality of life [10].

Diuretic therapy

Pharmacological treatment using diuretics—combined with albumin and vasoactive agents—is considered the first-line approach for managing ascites in cancer patients [1]. This therapy most commonly involves aldosterone receptor antagonists, such as spironolactone. In certain cases, spironolactone is combined with loop diuretics such as furosemide [11]. Furosemide is a fast-acting loop diuretic that inhibits the $Na^+/K^+/2Cl^-$ cotransporter in the thick ascending limb of the loop of Henle. As a result, it reduces sodium and chloride reabsorption, increasing their excretion in urine. Recommended dosage regimens typically start with 20 mg/day of oral furosemide as monotherapy. When combined with spironolactone at 25 mg/day, the furosemide dose may be increased to 40 mg/day. Alternatively, combination therapy may begin with 20 mg of furosemide and 25 mg of spironolactone per day, with possible increases to 40 mg and 50 mg/day, respectively [12]. In a study by Pockros et al., spironolactone doses of 100–400 mg/day alleviated ascites symptoms and resulted in a weight loss of approximately 1 kg/day [13]. However, several studies have reported limited efficacy of conventional diuretics in certain patients [14]. For instance, Lee et al. observed that diuretics were used in 61% of patients with malignant ascites, but only 45% experienced clinical benefit [15].

The SAAG index (Serum-Ascites Albumin Gradient) is a useful tool for predicting the potential effectiveness of diuretic therapy. The heterogeneous efficacy of diuretics in malignant ascites may be due to its complex, multifactorial etiology. Diuretics are expected to be most effective in patients whose ascites is caused by portal hypertension secondary to hepatic tumors, hepatic vein obstruction due to tumor, or portal vein thrombosis. Diuretics show the greatest efficacy in transudative ascites (SAAG > 1.1 g/dL) [16]. In patients with cirrhosis and ascites resistant to conventional diuretics, as well as those with hyponatremia, short-term use of vaptans may be beneficial [17]. Vaptans are selective vasopressin V2 receptor antagonists, acting on principal cells in the collecting ducts. They work by blocking the binding of antidiuretic hormone (ADH), increasing free water excretion and affecting sodium concentration in the urine. Tolvaptan has been approved in Europe and the U.S. for the treatment of malignant ascites. As an adjunctive therapy, it may lead to short-term improvements in both clinical symptoms and biochemical parameters [18]. Outside of Japan, where tolvaptan is used as second-line therapy in patients with preserved renal function, the optimal treatment duration has not been clearly established. Additionally, data from phase II trials have not confirmed consistent therapeutic benefit, and therefore the drug is not currently recommended as standard treatment [19]. Use of diuretics can lead to various adverse effects, including acute kidney injury (AKI), electrolyte imbalances, hepatic encephalopathy, gynecomastia, and muscle cramps. Thus, regular and careful monitoring is essential—especially during the first weeks of therapy—to identify and manage potential complications. Monitoring should include body weight, electrolytes, blood pressure, and hydration status to avoid excessive dehydration.

Paracentesis

The most commonly used method for managing malignant ascites is repeated paracentesis, which allows the removal of several liters of fluid from the peritoneal cavity, providing symptomatic relief in up to 90% of patients. Selecting the optimal drainage technique for a given patient is crucial for treatment efficacy but poses a significant clinical challenge. The process should begin with a detailed patient interview, ideally using standardized quality-of-life assessment tools. Equally important are factors related to the cancer's characteristics and the planned treatment strategy, including expected survival time and potential benefits or risks associated with drainage. Peritoneal fluid drainage should be regarded as supportive care that can be implemented at any stage of the disease to improve symptom control, quality of life, and overall treatment outcomes [20]. A multicenter prospective observational study conducted between 2018 and 2021 found that 81% of patients undergoing paracentesis with either a temporary (73%) or permanent (21%) catheter experienced rapid clinical improvement, particularly regarding abdominal bloating, pain, and nausea [21]. Of interest is the role of steroid administration in adjunctive therapy. A 2024 case study by Nashdi Islam et al. reported that intraperitoneal steroid injections in patients with recurrent malignant ascites doubled the median interval between paracenteses—from 9 to 18 days. These findings suggest that steroid therapy may serve as an effective treatment option for recurrent malignant ascites and contribute to improved patient quality of life. However, further research is needed to determine the optimal dosing regimen and identify subgroups most likely to benefit [22]. After paracentesis, plasma volume replacement is necessary to avoid complications. Plasma expanders such as dextran-70, polygeline, or normal saline may be as effective as 20% albumin solution (8 g/L)—but only when less than 5 liters of ascitic fluid are removed. Meta-analyses of randomized clinical trials have shown that albumin is superior to other fluid therapies and vasoconstrictive drugs, effectively preventing paracentesis-related complications [23]. Unfortunately, symptoms tend to recur within weeks due to fluid reaccumulation. Moreover, frequent paracentesis may increase the risk of infection, bowel perforation, peritonitis, hypotension, and electrolyte or protein imbalances [24].

Peritoneovenous shunting

Peritoneovenous shunting is a medical procedure that enables the drainage of ascitic fluid from the peritoneal cavity directly into the venous system, usually the internal jugular vein. It is used in cases of refractory ascites, particularly those unresponsive to conservative treatments such as diuretics [25]. The shunt is a long, subcutaneously implanted catheter equipped with a one-way valve to prevent blood reflux into the peritoneal cavity. This device facilitates the movement of ascitic fluid into the systemic circulation, allowing for reabsorption in the venous system. Several types of peritoneovenous shunts are used in clinical practice, including the LeVeen valve system and the Denver shunt, which features a manual silicone pump placed under the skin with two anti-reflux valves [26]. An analysis of 35 patients who underwent Denver shunt placement for malignancy-related ascites between October 2014 and 2017 showed symptom relief in 29 patients (82.9%), particularly regarding abdominal distension. However, postoperative complications of Clavien-Dindo grade ≥2 occurred in 11 patients (31.4%), and grade 5 complications (treatment-related deaths) were observed in 3 patients (8.6%). Multivariate logistic regression identified the volume of ascitic fluid drained during surgery as an independent risk factor for postoperative complications [27]. A retrospective study (2010–2021) of 54 patients (including 35 with hepatocellular carcinoma) undergoing peritoneovenous shunting for refractory ascites reported weight loss in 39 patients, improved eGFR in 34, and 17 deaths. These findings indicate the therapy's effectiveness in reducing ascites and improving renal function, particularly in patients with hepatocellular carcinoma [28]. The Denver shunt is a valuable palliative option for patients with malignant ascites, especially in improving quality of life. However, careful patient selection is essential, taking into account the general clinical condition and the planned extent of ascitic fluid drainage.

Indwelling peritoneal catheters (IPC)

There is growing interest in the use of tunneled, indwelling peritoneal catheters (IPC) for the management of malignant ascites. The catheter is surgically or percutaneously inserted into the peritoneal cavity, with its external tip tunneled subcutaneously to reduce the risk of infection and ensure device stability [29]. The implantation procedure is typically minimally invasive, well tolerated even in palliative care settings. These catheters are associated with a relatively low complication rate, with the most common being insertion-site infections, catheter blockage, and fluid leakage around the exit site. The most commonly used IPC systems are PleurX and Tenckhoff catheters, which enable self-managed or assisted fluid drainage at home [30]. This home-based solution eliminates the need for frequent hospital visits, significantly improving patients' quality of life and daily comfort. IPCs allow safe, controlled decompression of ascitic fluid outside the hospital setting, effectively relieving symptoms such as abdominal fullness, dyspnea, and abdominal pain. PleurX catheters are tunneled drainage systems designed for long-term peritoneal fluid evacuation. They consist of a silicone tube with an antibacterial filter and a one-way valve that connects securely to a disposable vacuum drainage kit [29]. On the other hand, Tenckhoff catheters, originally developed for peritoneal dialysis, are also used to treat ascites, especially in patients requiring continuous or frequent drainage [31]. The Tenckhoff catheter has a different structure, typically with two Dacron cuffs that stabilize the catheter subcutaneously and reduce infection risk. It can be used in both continuous and intermittent modes, depending on clinical needs [32]. A prospective study by Petzold et al. evaluated the safety and efficacy of IPCs in patients with malignant ascites. Among 50 patients analyzed, effective fluid drainage was achieved in 98%, leading to significant improvements in dyspnea, bloating, loss of appetite, and abdominal girth. The study reported a low complication rate, with only one superficial site infection (2%) and one case of catheter displacement. No serious peritonitis or life-threatening complications occurred. Compared to standard paracentesis, this method provided greater comfort, fewer interventions, and improved quality of life [31]. In patients requiring frequent paracenteses with an expected survival >2–3 months, IPC placement is often considered a long-term solution. Compared to paracentesis, IPCs offer longer symptom control and lower recurrence rates [33]. Ascites control can be achieved in 83%–100% of patients, with a median catheter patency time exceeding 50 days. In some cases, catheters remained functional for over a year [34]. Van Vliet and colleagues also conducted a retrospective analysis of 95 patients with refractory malignant ascites treated with tunneled peritoneal catheters. They assessed drainage effectiveness, symptom relief, and safety. Results showed significant symptom reduction (pain, bloating, dyspnea) in 90% of patients, leading to notable improvements in quality of life. Catheter implantation was well tolerated, with complications occurring in ~20% of cases—the most common being catheter dysfunction. Catheter-related infections were reported in 7% of patients, indicating a relatively low infection risk with proper prophylaxis and care [35].

Intraperitoneal chemiotherapy

Intraperitoneal chemotherapy (IPC) is a commonly used modality in combination with cytoreductive surgery for treating peritoneal carcinomatosis. Pharmacokinetic studies indicate that compared to systemic chemotherapy, intraperitoneal administration allows for higher local drug concentrations in the peritoneal cavity, extending the drug's duration of action, reducing systemic toxicity, and enhancing antitumor effects. The probable mechanism of IPC involves targeting microscopic tumor cells on the peritoneal surface—cells responsible for the development of malignant ascites—and inducing fibrotic responses, which may help prevent further fluid accumulation. The efficacy of treatment is dependent on the type of chemotherapy used. Agents like mitoxantrone and nitrogen mustard compounds have fallen out of favor, while drugs such as bleomycin, taxanes, and platinum-based agents have shown benefit in up to two-thirds of patients, even when used without surgery [36]. Another promising approach is hyperthermic intraperitoneal chemotherapy (HIPEC). This method emerged from evidence that heating chemotherapeutic agents to ≥40°C increases their cytotoxic potential, enhances tissue penetration, and selectively targets malignant cells within the peritoneal cavity. Several studies have demonstrated that HIPEC, when combined with cytoreductive surgery, offers significant palliative benefits in the management of malignant ascites [37].

Conclusions

Malignant ascites in the course of gastrointestinal cancers represents a serious clinical issue, significantly reducing patients' quality of life and often limiting further oncological treatment options. Its pathophysiology is complex and differs from that of non-malignant ascites, which impacts the effectiveness of available therapeutic approaches. Key symptomatic treatment options include repeated paracentesis, diuretic pharmacotherapy, peritoneovenous shunts, indwelling peritoneal catheters and intraperitoneal chemotherapy. In recent years, novel therapeutic strategies such as immunotherapy, photothermal therapy and HIPEC have emerged, offering hope for more effective ascites control in selected patients. Optimal management should be individualized, taking into account the patient's clinical status, tumor progression and expected survival time. Further research is essential to determine the efficacy of modern methods and to develop guidelines that support clinical decision-making.

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