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Renal dysfunction in individuals with ovarian cancer; a review on current concepts

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ABSTRACT

Renal impairment is a common complication in patients with ovarian cancer. Renal impairment in ovarian cancer patients can be caused by various factors. Many of the chemotherapeutic agents administered to treat ovarian cancer are nephrotoxic and can promote kidney dysfunction, leading to renal impairment. Ovarian tumors can obstruct the urinary tract, leading to a reduction in renal function and dilation of the upper urinary tract. Acute kidney injury (AKI) can occur in ovarian cancer patients undergoing cytoreductive surgery and hyperthermic intraperitoneal chemotherapy. Women treated for epithelial ovarian cancer suffer an accelerated rate of renal function decline, independent of major risk factors for kidney disease. Conversely, renal impairment can affect the dosage of chemotherapy drugs used in ovarian cancer treatment. Dose reduction, dose adjustment based on pharmacokinetic data, alternative treatment regimens, and individualized dosing may be necessary to ensure optimal therapeutic outcomes while minimizing the risk of toxicity and treatment-related complications.

Implication for health policy/practice/research/medical education:

Renal impairment is a common complication in patients with ovarian cancer. Kidney dysfunction following ovarian cancer can be caused by a variety of factors, including tumor obstruction, chemotherapy toxicity, and dehydration. Patients with ovarian cancer who develop renal impairment may experience symptoms such as fatigue, nausea, vomiting, and swelling in the legs and feet. Treatment options for renal impairment in these patients may include hydration therapy, and medications to manage electrolyte imbalances. In addition to managing the symptoms of renal impairment, it is important to address the underlying cause of the condition. For example, if the impairment is caused by tumor obstruction, surgery or radiation therapy may be necessary to remove or shrink the tumor.

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Introduction

Renal impairment can occur, as a result of various factors such as chemotherapy treatment for ovarian cancer or other underlying conditions that affect kidney function (1). In some cases, certain types of chemotherapy drugs administered to treat ovarian cancer may cause damage to the kidneys leading to renal impairment (2). Additionally, tumors pressing on the nearby organs including the kidneys can also lead to renal impairment. Other causes include dehydration due to nausea and vomiting caused by chemotherapy, infections, high blood pressure, and diabetes. Patients with ovarian cancer who have undergone surgery are at a higher risk for developing renal

impairment as well (3,4). In this study, we will discuss on renal dysfunction in individuals with ovarian cancer.

Search strategy

We conducted a review by searching several databases including PubMed, Web of Science, EBSCO, Scopus, Google Scholar, Directory of Open Access Journals (DOAJ), and Embase. We used various keywords such as acute kidney injury, ovarian cancer, chemotherapy, cancer metastases, hypertension, diabetes, radiation therapy, chronic kidney disease, hematuria, chemotherapy-induced nephrotoxicity, paraneoplastic syndromes, chemo-preventive agents, and cisplatin.

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Kidney dysfunction following ovarian cancer

Chemotherapy drugs used to treat ovarian cancer can cause various side effects in patients with renal impairment. Cisplatin, a commonly used chemotherapy drug for ovarian cancer, can cause kidney damage (5). Patients with renal impairment are at a higher risk of developing kidney damage as a result of chemotherapy. Chemotherapy drugs can cause nausea and vomiting, which can be more severe in patients with renal impairment (4). Both cisplatin and taxanes, another class of chemotherapy drug used to treat ovarian cancer, can cause neuropathy (6). Chemotherapy drugs can cause hair loss (alopecia), which can be more severe in patients with renal impairment. Additionally, chemotherapy drugs can cause neutropenia, which can increase the risk of infections. Moreover, chemotherapy drugs can cause fatigue, which can be more severe in patients with renal impairment. Finally, chemotherapy drugs can cause pain, which can be more severe in patients with renal impairment (7,8).

Renal histopathology following ovarian cancer

The histopathological features of ovarian cancer metastases in the kidneys include infiltration of cancer cells into the renal parenchyma, vascular invasion, and tubular damage. These changes can lead to impaired kidney function and renal failure (9,10).

Renal histopathology is often involved in cases of ovarian cancer due to metastasis or direct extension from adjacent organs such as the uterus or fallopian tubes (11,12).

Metastatic lesions to the kidney will appear, when ovarian cancer spreads through the lymphatics or bloodstream to involve the kidneys (13). The most common finding is multiple small tumor nodules within the renal parenchyma, which may be either solid or cystic in appearance. These tumors can range in size from microscopic to several centimeters in diameter and are often associated with necrosis and hemorrhage (12,13). In some cases, there may also be areas of inflammation around the tumor. The tumors can have a papillary or tubular growth pattern and may form clusters that resemble angiomyxoid hyperplasia (14,15).

Direct extension from ovarian cancer to the kidneys occurs when the tumor invades adjacent structures such as the uterus or fallopian tubes and extends through the pelvic cavity. This results in a thickened renal capsule and hematomyelia, which is characterized by the presence of blood within the renal parenchyma (11,16). There may also be fibrosis and sclerosis of the renal tissue due to scarring from the tumor invasion. In some cases, there may be areas of necrotizing inflammation around the tumors (9,17).

In addition to metastatic lesions and direct extension, other findings on renal histopathology can include chronic kidney disease such as glomerulonephritis or interstitial fibrosis, infectious processes like pyelitis or abscesses, and benign conditions such as angiomylipoma or

oncocytoma. However, these are less common in patients with ovarian cancer (9,18).

The clinical implications of renal involvement by ovarian cancer depend on the extent and severity of the lesions. Metastasis may cause symptoms such as flank pain, hematuria, and hypertension due to obstruction of the urinary tract. Direct extension can lead to hydronephrosis and renal insufficiency. The presence of metastatic disease or direct extension on renal histopathology helps guide treatment decisions and prognosis for patients with ovarian cancer (9,19).

Renal impairment is a common complication in patients with ovarian cancer, particularly in those with advanced disease. This can be due to several factors, including tumor-related obstruction of the urinary tract, chemotherapy-induced nephrotoxicity, and paraneoplastic syndromes (20). In addition, certain chemopreventive agents administered in ovarian cancer may also affect renal function. For example, platinum-based chemotherapy drugs such as cisplatin and carboplatin are commonly used in the treatment of ovarian cancer but can cause kidney damage (21,22). Therefore, careful monitoring of kidney function is essential in patients receiving these agents. Other chemopreventive agents that may affect renal function in ovarian cancer include targeted therapies such as bevacizumab and PARP [Poly (ADP-ribose) polymerase] inhibitors. Bevacizumab can cause proteinuria and hypertension, which can lead to renal impairment, while PARP inhibitors may increase the risk of acute kidney injury (AKI) (23,24).

Prognosis of ovarian cancer in patients with renal impairment

The prognosis for ovarian cancer patients with renal impairment can vary depending on various factors, including the extent of renal impairment, the stage of ovarian cancer, and the overall health of the patient (25). However, renal impairment in ovarian cancer patients is generally associated with a poorer prognosis. Renal impairment caused by chemotherapy in ovarian cancer patients can affect the efficacy of cancer treatment and the overall survival of the patient (2). If renal impairment is caused by tumor obstruction of the urinary tract, the prognosis may depend on the extent of obstruction and the response to treatment. Prompt intervention to relieve the obstruction and restore renal function can improve the prognosis (26). AKI in ovarian cancer patients can have a negative impact on prognosis. It is important to manage AKI promptly and provide appropriate supportive care to improve outcomes (27).

In addition to the functional changes in the kidney, ovarian cancer can also cause structural changes in the renal tissue. Histopathological studies have shown that ovarian cancer can metastasize to the kidney and cause various types of lesions, including tubular damage, glomerular injury, interstitial fibrosis, and vascular

changes as mentioned above (9). Tubular damage can manifest as tubular atrophy, dilation, and necrosis, while glomerular injury can present as mesangial expansion, sclerosis, and crescent formation. Interstitial fibrosis is characterized by the deposition of collagen fibers and infiltration of inflammatory cells, while vascular changes can lead to thrombosis and ischemia (28,29). The severity and extent of these renal histopathological changes depend on various factors, such as the stage of ovarian cancer, the type of chemotherapy used, and the presence of comorbidities such as hypertension and diabetes (30,31).

The prognosis for ovarian cancer patients with renal impairment is generally poorer compared to those without renal impairment. However, individual prognosis can vary based on the specific circumstances of each patient. It is important for healthcare providers to assess and manage renal impairment in ovarian cancer patients to optimize prognosis and quality of life. Renal impairment can significantly affect the treatment of ovarian cancer (25,32). Many chemotherapeutic agents used to treat ovarian cancer are nephrotoxic and can promote kidney dysfunction. Renal impairment can affect the clearance and metabolism of these drugs, potentially reducing their effectiveness in killing cancer cells. This may require adjustments in chemotherapy dosing or the use of alternative treatment regimens to ensure optimal therapeutic outcomes (2,5). Renal impairment can increase the risk of treatment-related complications, such as acute renal injury. AKI can lead to delays or modifications in chemotherapy schedules, affecting the overall treatment plan and potentially compromising the effectiveness of therapy. In some cases, the presence of renal impairment may limit the choice of chemotherapy agents. Nephrotoxic drugs may need to be avoided or used with caution in patients with compromised renal function. This can impact treatment options and require the exploration of chemotherapy-free regimens for patients with chronic kidney disease. Renal impairment requires close monitoring of renal function throughout the course of treatment (33,34).

Renal impairment in ovarian cancer patients can affect the efficacy of chemotherapy, increase the risk of treatment complications, influence treatment selection, and require careful monitoring and management. It is crucial for healthcare providers to consider renal function when planning and delivering treatment to optimize outcomes for patients with ovarian cancer and renal impairment (2,35).

Renal impairment and chemotherapy drugs for ovarian cancer

Renal impairment can affect the dosage of chemotherapy drugs used in ovarian cancer treatment. Chemotherapy drugs may need to be administered at a reduced dose in patients with renal impairment to prevent toxicity and minimize the risk of treatment-related complications.

Dose reduction may be necessary for drugs that are primarily eliminated by the kidneys or have a narrow therapeutic index (20,36). Dose adjustment based on pharmacokinetic data: For patients with renal impairment, dose adjustments are often based on pharmacokinetic data obtained during clinical trials. This can help ensure that patients receive optimal doses of chemotherapy drugs while minimizing the risk of toxicity (37,38). In some cases, renal impairment may limit the choice of chemotherapy agents, and alternative treatment regimens may need to be explored. Non-platinum drugs such as doxorubicin, paclitaxel, gemcitabine, docetaxel, and etoposide may be recommended for platinum-resistant or platinum-sensitive ovarian cancer patients with renal impairment (2). Dosing of chemotherapy drugs in ovarian cancer patients with renal impairment should be individualized based on the patient's renal function, overall health, and other factors that may impact drug metabolism and clearance. Close monitoring of renal function and regular assessment of drug efficacy and toxicity are crucial in these cases (36,39).

Risk factors for renal impairment in ovarian cancer patients

Many of the chemotherapeutic agents administered to treat ovarian cancer are nephrotoxic and can promote kidney dysfunction, leading to renal impairment. Ovarian tumors can obstruct the urinary tract, leading to a reduction in renal function and dilation of the upper urinary tract (4). Older age has been identified as a risk factor for renal impairment in ovarian cancer patients. Patients with pre-existing renal disease are at a higher risk of developing renal impairment as a result of chemotherapy or tumor obstruction (1). Whole abdominal irradiation has been associated with long-term renal function decline in patients with ovarian cancer. Long-term chemotherapy for recurrent ovarian cancer has been associated with an increased risk of neoplastic and renal complications (40,41).

How does renal impairment affect the prognosis of ovarian cancer patients?

Renal impairment can affect the clearance and metabolism of chemotherapy drugs, potentially reducing their effectiveness in killing cancer cells (2,20). This may require adjustments in chemotherapy dosing or the use of alternative treatment regimens to ensure optimal therapeutic outcomes. Renal impairment can increase the risk of treatment-related complications, such as AKI. AKI can lead to delays or modifications in chemotherapy schedules, affecting the overall treatment plan and potentially compromising the effectiveness of therapy. Hence, renal impairment is associated with a poorer prognosis in ovarian cancer patients (34,36).

Patients with renal impairment may have a higher risk of disease progression, recurrence, and mortality compared

to those without renal impairment. Accelerated rate of renal function decline: Women treated for epithelial ovarian cancer may experience an accelerated rate of renal function decline, which can further worsen the prognosis (2,42).

Conclusion

Renal impairment can have a negative impact on the prognosis of ovarian cancer patients. It can reduce the efficacy of chemotherapy, increase the risk of treatment-related complications, and worsen overall survival. Likewise, renal impairment is a common complication in patients with ovarian cancer, and it can have a negative impact on prognosis. Chemotherapy drugs used to treat ovarian cancer can be nephrotoxic and promote kidney dysfunction, leading to renal function and structure impairment.

Authors' contribution

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Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

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