e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(4); 421-428

Original Research Article

Evaluation of the Incidence of Renal Impairment as an Adverse Event Associated with Platinum-Based Chemotherapy

Aparajeeta[1], Mukesh Kumar Bharti[2]

[1]Senior Resident, Department of Radiation Oncology, Darbhanga medical college and Hospital, Laheriasarai, Darbhanga, Bihar, India.

[2]Professor and HOD, Department of Radiotherapy, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India.

Received: 01-03-2026 / Revised: 11-04-2026 / Accepted: 30-04-2026

Corresponding Author: Dr. Aparajeeta

Conflict of interest: Nil

Abstract:

Background: Platinum-based chemotherapeutic agents, including cisplatin, carboplatin, and oxaliplatin, are widely used in the treatment of various solid malignancies. Despite their proven anticancer efficacy, these agents are associated with nephrotoxicity, which may compromise treatment outcomes and patient safety. Data regarding the incidence of platinum-induced renal impairment in the Indian population remain limited.

Aim: To evaluate the incidence of renal impairment as an adverse event associated with platinum-based chemotherapy and to identify factors associated with its occurrence among cancer patients.

Methodology: A retrospective observational study was conducted in the Department of Radiation Oncology, Darbhanga Medical College and Hospital, Bihar, India. Medical records of 79 adult cancer patients who received at least one cycle of platinum-based chemotherapy were reviewed. Demographic, clinical, and laboratory data were collected, and renal function was assessed using serum creatinine, blood urea nitrogen (BUN), and estimated glomerular filtration rate (eGFR). Statistical analysis was performed using SPSS version 25.0, with $p < 0.05$ considered statistically significant.

Results: Renal impairment occurred in 22.8% of patients. Elevated serum creatinine was the most common manifestation, and most cases were mild to moderate in severity. Cisplatin demonstrated the highest incidence of nephrotoxicity compared with carboplatin and oxaliplatin ($p = 0.033$). Advanced age, diabetes mellitus, hypertension, and baseline renal dysfunction were significantly associated with renal impairment. Significant post-treatment deterioration in serum creatinine, BUN, and eGFR were also observed.

Conclusion: Renal impairment is a clinically significant adverse event associated with platinum-based chemotherapy, particularly with cisplatin use. Regular renal monitoring and early identification of high-risk patients are essential to minimize nephrotoxicity and improve treatment safety.

Keywords: Platinum-based chemotherapy, Renal impairment, Nephrotoxicity, Cisplatin, Carboplatin, Oxaliplatin, Cancer, Adverse drug reaction, eGFR, Kidney dysfunction.

DOI: 10.25258/ijpqa.17.4.67

Introduction

Cancer remains one of the leading causes of morbidity and mortality worldwide, posing a substantial public health challenge despite significant advances in diagnosis and treatment. Chemotherapy remains a key approach to treating a range of cancers as either a standalone treatment or alongside other treatments such as surgery, radiotherapy, targeted therapy and immunotherapy. Platinum-based compounds are one of the most effective and widely used classes of anti-cancer drugs available. These agents have shown significant therapeutic value against a number of solid tumor cancers such as lung, ovary, cervix, bladder, breast, head and neck and testes [1]. Platinum compounds have a wide spectrum of tumor suppressing activity and have proven to be effective in the treatment of cancer and continue to be used in many chemotherapy regimens in oncology centers around the world.

In clinical practice, chemotherapy agents based on platinum are widely used such as cisplatin, carboplatin, oxaliplatin and nedaplatin [2]. These drugs have a similar chemical structure (platinum) and they both produce anti-cancer effects by causing damage to DNA and blocking cellular growth, but their toxicities are very different. In addition to their therapeutic benefits, platinum compounds are also known to cause various side effects, such as nephrotoxicity, gastrointestinal toxicity, myelosuppression, neurotoxicity, and ototoxicity. These side

effects can reduce adherence to treatment, require dose adjustments and can impact on the quality of life and treatment outcomes for the patient. This means it is crucial to know how common and serious chemotherapy side effects are, to make sure cancer treatment is as effective and safe as possible.

Of the many toxicities of platinum agents, renal dysfunction is one of the most clinically relevant. Many chemotherapeutic drugs are excreted and metabolized by the kidneys, making them highly susceptible to kidney damage caused by drugs. The platinum compounds, particularly cisplatin, may be taken up by the renal tubular epithelial cells resulting in cellular injury, inflammation, oxidative stress, and renal dysfunction [3]. Renal impairment can present as acute kidney injury, electrolyte disturbances, diminished glomerular filtration rate or chronic kidney dysfunction. These can lead to a delay in treatment, decrease in doses, longer hospital stays, higher health care expenses, and even permanent kidney damage in more serious cases.

There is a general consensus that cisplatin is the most nephrotoxic platinum drug available in the field of oncology. It is known to cause severe renal tubular damage and decrease in the glomerular filtration rate, which is one of its major dose-limiting toxicities [4]. Cumulative dose exposure, advanced age, dehydration, prior renal disease, administration of nephrotoxic drugs, and the presence of comorbidities including diabetes mellitus and hypertension are risk factors for cisplatinum induced renal impairment. Although several measures have been taken to prevent nephrotoxicity, such as aggressive hydration and electrolyte supplementation, the problem remains as a major concern in patients undergoing cisplatin-based chemotherapy regimens.

Newer platinum analogues have been developed to overcome some of the toxic effects associated with these platinum-based compounds. Carboplatin is a second-generation platinum derivative with a better safety profile and is usually linked to a decreased rate of nephrotoxicity, nausea, and vomiting than cisplatin [5,6]. Consideration should be given to using a more stable analogue, such as carboplatin, which is often used in patients with high risk for renal-related complications. However, some patients may develop renal dysfunction, especially older patients and those who already have kidney disease. Nedaplatin also is reported to be much less nephrotoxic than cisplatin and carboplatin, thus making it a potentially safer alternative in certain patient cohorts [7]. Oxaliplatin is a third-generation platinum compound, which is relatively low nephrotoxic, but clinically may be restricted by cumulative peripheral neurotoxicity [8]. Although there are differences in toxicity profiles, it is important that all platinum compounds be monitored carefully as adverse renal events could affect treatment efficacy and patient safety.

This is especially significant in developing nations like India, where the incidence of cancer is steadily increasing and healthcare facilities may be limited. As access to oncology services has improved in Bihar, as in many parts of India, the use of platinum-based chemotherapy regimens has also increased. Data on the incidence and nature of platinum-induced renal impairment in Indian patients, however, remain limited. The bulk of the available evidence comes from Western countries or pharmacovigilance databases, which may not be representative of the clinical features, treatment patterns, comorbidities, and healthcare environments experienced by patients in India. Regional studies are thus essential to provide context-specific evidence that can inform clinical decision-making and enhance patient management.

Identifying renal impairment, early enough, in patients receiving chemotherapy is essential since this intervention may help to prevent progression to significant renal injury and allow the continuation of anti-cancer therapy. Routine testing of serum creatinine estimated GFR, and electrolytes should be performed in patients taking platinum-based drugs. In addition, knowing the prevalence of renal impairment and the risk factors associated with it could help the clinicians to use preventive measures, tailor treatment strategies, and improve supportive care.

Considering the clinical importance of renal damage and the dearth of information for the region, the present study was conducted to assess the prevalence of renal damage as an adverse event in cancer patients treated in Bihar, India with platinum-based chemotherapy. The purpose of this study is to provide important information about the safety profile of platinum compounds in patients treated with these drugs, and to help develop plans to reduce renal toxicity associated with treatment.

Materials and Methods

Study Design: This retrospective observational study was conducted to evaluate the incidence of renal impairment as an adverse event associated with platinum-based chemotherapy among cancer patients receiving treatment at a tertiary care teaching hospital. The study involved a review of medical records of eligible patients who had received platinum-containing chemotherapy regimens during the study period.

Study Area: The study was carried out in the Department of Radiation Oncology, Darbhanga Medical College and Hospital (DMCH) Laheriasarai, Darbhanga, Bihar, India and Swami Vivekanand Cancer Aspatal, Mabbi.

Study Duration: The study was conducted over a period of 11 months from March 2025 to January 2026.

Sample Size: A total of 79 patients who received platinum-based chemotherapy and fulfilled the eligibility criteria were included in the study.

Study Population: The study population consisted of adult cancer patients treated with platinum-based chemotherapeutic agents, including cisplatin, carboplatin, and oxaliplatin, in the Department of Radiation Oncology during the study period. Patients with various malignancies receiving these agents either as monotherapy or in combination regimens were evaluated for the occurrence of chemotherapy-related renal impairment.

Data Collection: Data were collected retrospectively from patient medical records, chemotherapy treatment charts, laboratory reports, and hospital electronic databases. Information extracted included demographic characteristics (age and sex), cancer diagnosis, type of platinum compound administered, chemotherapy regimen, number of treatment cycles, baseline renal function parameters, follow-up renal function assessments, comorbid conditions, and documented adverse events.

Renal function was assessed using serum creatinine levels, blood urea nitrogen (BUN), estimated glomerular filtration rate (eGFR), and clinical documentation of renal impairment. Cases of renal impairment were identified through laboratory abnormalities and physician-documented diagnoses occurring after initiation of platinum-based chemotherapy.

Inclusion Criteria

1. Patients aged 18 years and above.
2. Patients diagnosed with any malignancy and treated with platinum-based chemotherapy.
3. Patients who received at least one cycle of cisplatin, carboplatin, or oxaliplatin.
4. Patients with available baseline and follow-up renal function test records.
5. Patients whose medical records contained complete treatment and laboratory information relevant to the study.

Exclusion Criteria

1. Patients with incomplete or missing medical records.
2. Patients with documented severe renal impairment prior to initiation of chemotherapy.
3. Patients receiving concurrent nephrotoxic medications where attribution of renal impairment to platinum-based chemotherapy could not be determined.
4. Patients who discontinued treatment before undergoing follow-up renal assessment.
5. Patients with insufficient laboratory data for evaluation of renal function.

Study Procedure: Eligible patient records were identified from departmental treatment registers and hospital databases. Baseline demographic and clinical characteristics were recorded. Renal function parameters before initiation of chemotherapy were documented and compared with subsequent laboratory values obtained during and after chemotherapy administration.

Patients were monitored for evidence of renal impairment following exposure to platinum-based agents. Renal impairment was defined as a clinically significant increase in serum creatinine, reduction in eGFR, or physician-documented renal dysfunction occurring after initiation of chemotherapy. The incidence of renal impairment was calculated as the proportion of patients developing renal dysfunction among the total study population. The occurrence of renal impairment was further analyzed according to age, sex, type of malignancy, platinum compound used, and presence of comorbid conditions.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages.

The incidence of renal impairment was calculated as the number of patients who developed renal dysfunction divided by the total number of patients receiving platinum-based chemotherapy. Associations between renal impairment and categorical variables were evaluated using the Chi-square test or Fisher's exact test, as appropriate. Continuous variables were compared using the independent sample t-test. A p-value of less than 0.05 was considered statistically significant.

Result

Table 1 presents the baseline demographic and clinical characteristics of the 79 patients receiving platinum-based chemotherapy. The mean age of the study population was 54.8 ± 11.7 years, with the majority of patients being 60 years or younger (65.8%, n=52), while 34.2% (n=27) were older than 60 years. Males constituted 58.2% (n=46) of the cohort, whereas females accounted for 41.8% (n=33). Common comorbidities included hypertension in 26.6% (n=21) and diabetes mellitus in 22.8% (n=18) of patients. A baseline eGFR below 60 mL/min/1.73m² was present in 11.4% (n=9) of participants, indicating pre-existing renal dysfunction in a subset of patients. Additionally, 30.4% (n=24) had a history of smoking and 22.8% (n=18) reported alcohol consumption. Regarding the underlying malignancies, head and neck cancer was the most common diagnosis, accounting for 32.9% (n=26) of cases, followed by cervical cancer (22.8%, n=18), lung cancer (15.2%, n=12), ovarian cancer (10.1%, n=8), bladder cancer (7.6%, n=6), esophageal cancer (6.3%, n=5), and other malignancies (5.1%, n=4). In terms

of chemotherapy exposure, cisplatin was the most frequently used platinum compound (60.8%, n=48), followed by carboplatin (24.1%, n=19) and oxaliplatin (15.2%, n=12). These findings indicate that the study population predominantly consisted of middle-aged male patients with head and neck or cervical cancers, with cisplatin being the most commonly administered platinum-based chemotherapeutic agent.

Table 1: Baseline Demographic and Clinical Characteristics of Patients Receiving Platinum-Based Chemotherapy (N=79)	
Variable	**N (%)**
Age (years), Mean ± SD	54.8 ± 11.7
≤60 years	52 (65.8)
>60 years	27 (34.2)
Male	46 (58.2)
Female	33 (41.8)
Diabetes Mellitus	18 (22.8)
Hypertension	21 (26.6)
Baseline eGFR <60 mL/min/1.73m²	9 (11.4)
Smoking History	24 (30.4)
Alcohol Consumption	18 (22.8)
Primary Malignancy	
Type of Cancer	**N (%)**
Head and Neck Cancer	26 (32.9)
Cervical Cancer	18 (22.8)
Lung Cancer	12 (15.2)
Ovarian Cancer	8 (10.1)
Bladder Cancer	6 (7.6)
Esophageal Cancer	5 (6.3)
Others	4 (5.1)
Platinum Compound Used	
Drug	**N (%)**
Cisplatin	48 (60.8)
Carboplatin	19 (24.1)
Oxaliplatin	12 (15.2)

Table 2 presents the incidence and severity of renal impairment among the 79 patients receiving platinum-based chemotherapy. Overall, 22.8% (n=18) of patients developed renal impairment, whereas 77.2% (n=61) did not experience any significant renal dysfunction during treatment. Among the 18 affected patients, elevated serum creatinine was the most common manifestation of renal impairment, occurring in 55.6% (n=10) of cases, followed by acute kidney injury (AKI) in 27.8% (n=5) and reduced estimated glomerular filtration rate (eGFR) in 16.7% (n=3) patients. Assessment of severity according to the Common Terminology Criteria for Adverse Events (CTCAE) revealed that Grade 1 toxicity was the most frequent, accounting for 44.4% (n=8) of renal impairment cases. Grade 2 toxicity was observed in 33.3% (n=6) patients, while Grade 3 and Grade 4 renal impairment occurred in 16.7% (n=3) and 5.6% (n=1) of cases, respectively. These findings indicate that nearly one-quarter of patients developed chemotherapy-related renal impairment, with most cases being mild to moderate in severity, although a small proportion experienced severe nephrotoxic effects.

Table 2: Incidence and Severity of Renal Impairment Following Platinum-Based Chemotherapy (N=79)	
Variable	**N (%)**
Renal Impairment Present	18 (22.8)
Renal Impairment Absent	61 (77.2)
Type of Renal Impairment (n=18)	
Type	**N (%)**
Elevated Serum Creatinine	10 (55.6)

Acute Kidney Injury	5 (27.8)
Reduced eGFR	3 (16.7)
CTCAE Severity Grade (n=18)	
Grade	**N (%)**
Grade 1	8 (44.4)
Grade 2	6 (33.3)
Grade 3	3 (16.7)
Grade 4	1 (5.6)

Table 3 presents the incidence of renal impairment according to the type of platinum-based chemotherapeutic agent administered among the 79 study participants. Overall, 22.8% (n=18) of patients developed renal impairment, while 77.2% (n=61) maintained normal renal function during treatment. Cisplatin was associated with the highest incidence of renal impairment, with 31.3% (n=15/48) of patients developing nephrotoxicity, whereas 68.7% (n=33/48) did not experience renal impairment. In comparison, the incidence was substantially lower among patients receiving carboplatin, where only 10.5% (n=2/19) developed renal impairment and 89.5% (n=17/19) remained unaffected. Oxaliplatin demonstrated the lowest incidence, with renal impairment occurring in 8.3% (n=1/12) of patients, while 91.7% (n=11/12) showed no evidence of renal dysfunction. These findings indicate that cisplatin carries a markedly higher risk of renal impairment compared with carboplatin and oxaliplatin, highlighting its greater nephrotoxic potential among platinum-based chemotherapy agents.

Table 3: Incidence of Renal Impairment According to Platinum-Based Agent

Platinum Compound	Total Patients	Renal Impairment n (%)	No Renal Impairment n (%)
Cisplatin	48	15 (31.3)	33 (68.7)
Carboplatin	19	2 (10.5)	17 (89.5)
Oxaliplatin	12	1 (8.3)	11 (91.7)
Total	79	18 (22.8)	61 (77.2)

$\chi^2 = 6.82$, $p = 0.033$

Table 4 presents the association between selected clinical variables and the development of renal impairment among patients receiving platinum-based chemotherapy. Patients aged over 60 years were significantly more likely to develop renal impairment, with 55.6% (n=10) of affected patients belonging to this age group compared to 27.9% (n=17) among those without renal impairment (p=0.028). Similarly, diabetes mellitus was significantly associated with renal impairment, being present in 44.4% (n=8) of patients with renal dysfunction versus 16.4% (n=10) of those without it (p=0.014). Hypertension also showed a significant association, occurring in 50.0% (n=9) of patients with renal impairment compared to 19.7% (n=12) of patients without renal impairment (p=0.011). Additionally, a baseline eGFR below 60 mL/min/1.73m² was significantly more common among patients who developed renal impairment (27.8%, n=5) than among those who did not (6.6%, n=4) (p=0.019). In contrast, male gender was not significantly associated with renal impairment, despite being more frequent among affected patients (66.7%, n=12) than unaffected patients (55.7%, n=34) (p=0.412). These findings indicate that advanced age, diabetes mellitus, hypertension, and reduced baseline renal function are important risk factors for the development of chemotherapy-related renal impairment, whereas gender does not appear to significantly influence risk.

Table 4: Association Between Clinical Variables and Renal Impairment

Variable	Renal Impairment (n=18)	No Renal Impairment (n=61)	p-value
Age >60 years	10 (55.6)	17 (27.9)	0.028*
Male Gender	12 (66.7)	34 (55.7)	0.412
Diabetes Mellitus	8 (44.4)	10 (16.4)	0.014*
Hypertension	9 (50.0)	12 (19.7)	0.011*
Baseline eGFR <60	5 (27.8)	4 (6.6)	0.019*

Table 5 compares renal function parameters before and after platinum-based chemotherapy. A significant deterioration in renal function was observed following treatment. The mean serum creatinine level increased from 0.89 ± 0.21 mg/dL at baseline to 1.12 ± 0.38 mg/dL after chemotherapy, which was statistically significant (p=0.002). Similarly, the mean blood urea nitrogen (BUN) increased from

21.4 ± 6.8 mg/dL to 27.8 ± 8.9 mg/dL following treatment (p=0.001). In contrast, the mean estimated glomerular filtration rate (eGFR) declined significantly from 88.6 ± 15.4 mL/min/1.73m² at baseline to 76.2 ± 18.1 mL/min/1.73m² after chemotherapy (p=0.003). These findings demonstrate a statistically significant impairment in renal function following platinum-based chemotherapy, characterized by increased serum creatinine and BUN levels along with a reduction in eGFR, supporting the nephrotoxic potential of platinum-containing regimens.

Table 5: Renal Function Parameters Before and After Chemotherapy

Parameter	Baseline (Mean ± SD)	Post-Chemotherapy (Mean ± SD)	p-value
Serum Creatinine (mg/dL)	0.89 ± 0.21	1.12 ± 0.38	0.002*
Blood Urea Nitrogen (mg/dL)	21.4 ± 6.8	27.8 ± 8.9	0.001*
eGFR (mL/min/1.73m²)	88.6 ± 15.4	76.2 ± 18.1	0.003*

Discussion

In the present study, the incidence and determinants of renal impairment in patients receiving platinum-based chemotherapy were assessed and an overall nephrotoxicity incidence of 22.8% was observed. This confirms that renal impairment is a clinically significant platinum compound side effect that has not been prevented by improved hydration measures and supportive care. This has also been seen in other studies, where nephrotoxicity was listed as one of the more frequent doses limiting toxicities, particularly with cisplatin treatment (Yao et al., 2007; Ozkok & Edelstein, 2014) [9,10]. This incidence of clinically relevant nephrotoxicity is similar to what has been reported by de Jongh et al. (2003) [11] who reported that approximately 20–30% of patients receiving high-dose cisplatin-based regimen were reported to have clinically significant nephrotoxicity. This small difference between studies may be due to differences in patient characteristics, inclusion criteria, hydration status and renal impairment definitions, as well as different dosages and cumulative doses."

The current study showed that cisplatin was associated with the highest rate of renal impairment (31.3%) followed by carboplatin (10.5%) and oxaliplatin (8.3%) and this difference was statistically significant. The results are similar to those of previous experimental and clinical studies which showed that the nephrotoxicity of cisplatin is significantly higher than that of other platinum compounds. McDonald et al. (1991) [12] found that carboplatin is generally associated with much less renal toxicity than cisplatin, whereas Labaye et al. (2005) [13] reported that clinically significant nephrotoxicity due to oxaliplatin is relatively uncommon. Likewise, Uehara et al. (2005) [14] have shown in animal studies that cisplatin causes more severe renal tubular injury than the other platinum compounds. The nephrotoxicity caused by cisplastin is largely due to the preferential accumulation of the drug in the proximal tubular epithelial cells, causing oxidative stress, inflammation, mitochondrial dysfunction and apoptosis of the cells (Townsend et al., 2003; Ozkok & Edelstein, 2014) [10,15]. Thus, our results confirm the well-known fact that cisplatin is the most nephrotoxic of the platinum agents.

Our findings are also consistent with other literature, because the pattern of renal injury that we have observed is similar. The most frequent presentation was elevated serum creatinine (55.6%), followed by acute kidney injury (27.8%) and decreased eGFR (16.7%). Moreover, most of the events were of mild to moderate severity, with more than three fourths of the patients having Grade 1 and Grade 2 toxic effects. Yao et al. (2007) [9] reported the same results and indicated transient rise in serum creatinine as the most common clinical feature of renal dysfunction in patients receiving cisplatin. In our study, Grade 3 and Grade 4 nephrotoxicity were still reported, but were much less common; this highlights the importance of monitoring patients closely when giving these medications.

In the current study, age was found to be an important factor influencing renal impairment. Nephtrotoxicity was significantly more common in patients older than 60 years compared to those younger (55.6% vs. 27.9%). The same observation was reported by de Jongh et al. (2003) [11] who found advanced age to be an independent risk factor for renal toxicity due to cisplatin (Reference 4). Likewise, Mizuno et al. (2013) [16] showed that elderly cancer patients were at higher risk of developing severe A.K.I. after cisplatin chemotherapy. Older patients may be more vulnerable to renal damage caused by chemotherapy due to a decline in renal reserve, a reduction in the number of nephrons and impaired tubular regeneration.

Also, the nephrotoxicity developed was significant for comorbid conditions. In our study, diabetes mellitus was seen in 44.4% of the patients with renal impairment vs 16.4% of patients without nephrotoxicity, and hypertension was seen in 50.0% vs 19.7% of the patients, respectively. These two associations were both significant at the 0.05 level. These results are in line with previous studies showing diabetes and hypertension are among the most significant risk factors for kidney damage. Mizuno et al. 2013 [16] showed that acutely injured kidneys in diabetic patients receiving cisplatin were significantly

increased. Similarly, chronic hypertension results in microvascular and glomerular damage, which decreases renal reserves and makes the kidneys more susceptible to nephrotoxic agents. The interaction of these co-pathologies can enhance oxidative stress and compromise renal autoregulation, thus further sensitizing to nephrotoxicity of platins.

Another important predictor in our cohort was baselining renal dysfunction. The incidence of renal impairment was far higher than the incident of preserved renal function (27.8% vs. 6.6%) for those who had pre-treatment eGFR below 60 mL/min/1.73m². Ozkok and Edelstein (2014) [10] also reported that renal impairment before the onset of cisplatin treatment is a risk factor for acute kidney injury due to cisplatin because of decreased renal clearance and increased tubular exposure to toxic metabolites. The results of these are important because they emphasize the need for detailed baseline evaluation of renal function prior to platinum-containing chemotherapy.

Of note, male patients in our study had a higher prevalence of renal impairment than females (66.7% vs. 55.7%), but this was not significant. There have been conflicting results from past investigations on the effect of sex on cisplatin nephrotoxicity. There have been suggestions that women were more vulnerable to toxicity effects due to pharmacokinetic differences [11] and other reports indicated that women were less susceptible to toxicity than men [17]. There was no significant correlation in our study, indicating that sex is not a good predictor of nephrotoxicity and other clinical factors play a more important role.

Platinum compounds have additional nephrotoxicity signals in biochemical changes after chemotherapy. Mean serum creatinine increased significantly from 0.89 ± 0.21 mg/dL to 1.12 ± 0.38 mg/dL, while blood urea nitrogen rose from 21.4 ± 6.8 mg/dL to 27.8 ± 8.9 mg/dL. Concurrently, eGFR declined significantly from 88.6 ± 15.4 to 76.2 ± 18.1 mL/min/1.73m². Similar decreases in renal function have consistently been seen in renal cisplatin nephrotoxicity studies (Yao et al. 2007; Townsend et al. 2003) [9,15]. These changes are due to the cumulative injury to the tubules and the decrease in glomerular filtration due to the exposure to platinum.

In summary, the results of the present study are similar to earlier reports that cisplatin is the main source of platinum-associated nephrotoxicity, and that advanced age, diabetes mellitus, hypertension and preexisting renal dysfunction are significant risk factors for renal dysfunction. The findings confirm that there is a need to assess each patient individually for risk, closely monitor renal function during therapy, and implement steps to prevent treatment-induced kidney injury in patients receiving platinum-based chemotherapy.

Conclusion

This study showed that renal impairment is an important adverse event occurring in some patients treated with platinum-based chemotherapy. Across the various platinum agents, renal dysfunction was observed and more patients had renal dysfunction when treated with cisplatin. Advanced age, diabetes mellitus, hypertension and pre-existing renal dysfunction were found to be important factors that were associated with an increased risk of nephrotoxicity. Moreover, clinical worsening of kidney function parameters after chemotherapy emphasizes the need for careful monitoring of kidney function during chemotherapy. An early identification of high-risk patients, appropriate preventive strategies, and regular evaluation of renal status may help to decrease the burden of chemotherapy-induced nephrotoxicity and enhance the safety and outcomes of chemotherapy.

References

1. Rosenberg B, VanCamp L. The successful regression of large solid sarcoma 180 tumors by platinum compounds. Cancer research. 1970 Jun 1;30(6):1799-802.
2. Weiss RB and Christian MC. New cisplatin analogues in development: a review. Drugs 1993; 46: 360–377.
3. McWhinney SR, Goldberg RM, McLeod HL. Platinum neurotoxicity pharmacogenetics. Molecular cancer therapeutics. 2009 Jan 1;8(1):10-6.
4. Kris MG, Hesketh PJ, Somerfield MR, Feyer P, Clark-Snow R, Koeller JM, Morrow GR, Chinnery LW, Chesney MJ, Gralla RJ, Grunberg SM. American Society of Clinical Oncology guideline for antiemetics in oncology: update 2006. Journal of clinical oncology. 2006 Jun 20;24(18):2932-47.
5. Ardizzoni A, Boni L, Tiseo M, Fossella FV, Schiller JH, Paesmans M, Radosavljevic D, Paccagnella A, Zatloukal P, Mazzanti P, Bisset D. Cisplatin-versus carboplatin-based chemotherapy in first-line treatment of advanced non–small-cell lung cancer: an individual patient data meta-analysis. Journal of the National Cancer Institute. 2007 Jun 6;99(11):847-57.
6. Rajeswaran A, Trojan A, Burnand B, Giannelli M. Efficacy and side effects of cisplatin-and carboplatin-based doublet chemotherapeutic regimens versus non-platinum-based doublet chemotherapeutic regimens as first line treatment of metastatic non-small cell lung carcinoma: a systematic review of randomized controlled trials. Lung cancer. 2008 Jan 1;59(1):1-1.
7. Alberto ME, Lucas MF, Pavelka M, Russo N. The second-generation anticancer drug Nedaplatin: a theoretical investigation on the

hydrolysis mechanism. The Journal of Physical Chemistry B. 2009 Oct 29;113(43):14473-9.
8. Falcone A, Ricci S, Brunetti I, Pfanner E, Allegrini G, Barbara C, Crino L, Benedetti G, Evangelista W, Fanchini L, Cortesi E. Phase III trial of infusional fluorouracil, leucovorin, oxaliplatin, and irinotecan (FOLFOXIRI) compared with infusional fluorouracil, leucovorin, and irinotecan (FOLFIRI) as first-line treatment for metastatic colorectal cancer: the Gruppo Oncologico Nord Ovest. Journal of clinical oncology. 2007 May 1;25(13):1670-6.
9. Yao X, Panichpisal K, Kurtzman N, Nugent K. Cisplatin nephrotoxicity: a review. The American journal of the medical sciences. 2007 Aug 1;334(2):115-24.
10. Ozkok A, Edelstein CL. Pathophysiology of cisplatin-induced acute kidney injury. BioMed research international. 2014;2014(1):967826.
11. De Jongh FE, Van Veen RN, Veltman SJ, de Wit R, Van der Burg ME, Van den Bent MJ, Planting A, Graveland WJ, Stoter G, Verweij J. Weekly high-dose cisplatin is a feasible treatment option: analysis on prognostic factors for toxicity in 400 patients. British journal of cancer. 2003 Apr;88(8):1199-206.
12. McDonald BR, Kirmani S, Vasquez M, Mehta RL. Acute renal failure associated with the use of intraperitoneal carboplatin: a report of two cases and review of the literature. The American journal of medicine. 1991 Mar 1;90(3):386-91.
13. Labaye J, Sarret D, Duvic C, Hérody M, Didelot F, Nédélec G, Noël LH. Renal toxicity of oxaliplatin. Nephrology Dialysis Transplantation. 2005 Jun 1;20(6):1275-6.
14. Uehara T, Watanabe H, Itoh F, Inoue S, Koshida H, Nakamura M, Yamate J, Maruyama T. Nephrotoxicity of a novel antineoplastic platinum complex, nedaplatin: a comparative study with cisplatin in rats. Archives of toxicology. 2005 Aug;79(8):451-60.
15. Townsend DM, Deng M, Zhang L, Lapus MG, Hanigan MH. Metabolism of cisplatin to a nephrotoxin in proximal tubule cells. Journal of the American Society of Nephrology. 2003 Jan 1;14(1):1-0.
16. Mizuno T, Ishikawa K, Sato W, Koike T, Kushida M, Miyagawa Y, Yamada K, Hirata S, Imai E, Noda Y. The risk factors of severe acute kidney injury induced by cisplatin. Oncology. 2013 Dec 1;85(6):364-9.
17. Nematbakhsh M, Pezeshki Z, Jazi FE, Mazaheri B, Moeini M, Safari T, Azarkish F, Moslemi F, Maleki M, Rezaei A, Saberi S. Cisplatin-induced nephrotoxicity; protective supplements and gender differences. Asian Pacific journal of cancer prevention: APJCP. 2017;18(2):295.