

Platinum-Based Chemotherapies-Induced Nephrotoxicity: A Retrospective Analysis of Frequency, Clinical Characteristics, and Outcomes

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Abstract

Background

Platinum-based agents (cisplatin, carboplatin, and oxaliplatin) are essential in the treatment of solid tumors, but they are associated with nephrotoxicity. Acute kidney injury (AKI) occurs most frequently with cisplatin and can lead to treatment delays, dose reduction, or discontinuation, as well as increasing the risk of renal adverse events and mortality. In Latin America, evidence on incidence, associated factors, and outcomes is limited.

Aims

To estimate the frequency of platinum-induced chemotherapy nephrotoxicity, describe the clinical characteristics, and determine the renal and clinical outcomes in adults with solid tumors.

Methods

A retrospective, analytical cohort study was conducted on patients aged 18 years or older diagnosed with any solid tumor who had received at least one cycle of platinum-based chemotherapy over a 5-year period. Acute kidney injury was defined and classified according to the KDIGO 2026 criteria. Demographic variables, comorbidities, baseline renal function, electrolyte imbalances, exposure to nephrotoxic agents, tumor type, treatment regimen, and cumulative dose were collected. The frequency of nephrotoxicity by drug was estimated, and outcomes such as renal recovery, need for renal replacement therapy, regimen modifications/discontinuation, and mortality were explored.

Results

A total of 114 patients were included in the study. Testicular cancer was the most frequent neoplasm (29.8%). Acute kidney injury occurred in 31.6%, while electrolyte imbalances were documented in 35.1% of patients. Renal replacement therapy was required in 7.9%, and 7.0% developed chronic kidney disease. Treatment discontinuation occurred in 7.0% of the study population, while dose modification was necessary in 11.4%. Overall mortality was 1.8%.

Conclusions

Platinum exposure itself remains a determinant of nephrotoxicity, even in patients traditionally considered to have a relatively low renal risk. These observations suggest that the clinical burden of platinum nephrotoxicity extends far beyond short-term increases in serum creatinine, directly influencing

renal and oncological outcomes. This represents the first study published in Mexico and the second in Latin America.

HIGHLIGHTS

- Platinum-induced nephrotoxicity can manifest as acute kidney injury, acute kidney disease, electrolyte imbalances, tubulopathies, or persistent decline in renal function.
- The clinical consequences of platinum-induced nephrotoxicity extend beyond a transient increase in creatinine.
- In cancer patients, reduced therapeutic intensity can affect tumor control and overall prognosis.
- These findings support a proactive onconeurological approach that incorporates early intervention by a nephrologist when nephrotoxicity develops.

BACKGROUND

Platinum-derived compounds, primarily cisplatin, carboplatin, and oxaliplatin, constitute a fundamental part of the systemic treatment of many solid tumors. Their antitumor efficacy is due to the formation of cross-links with deoxyribonucleic acid (DNA), which interferes with cell replication and transcription, promotes apoptosis, and limits tumor proliferation. These drugs are used in gynecological, genitourinary, gastrointestinal, pulmonary, and head and neck tumors, among others. However, their clinical utility can be limited by systemic toxicity, among which nephrotoxicity represents one of the most relevant complications due to its impact on patient safety and continuity of cancer treatment (1, 2).

Platinum-induced nephrotoxicity can manifest as acute kidney injury, acute kidney disease, electrolyte imbalances, tubulopathies, or persistent deterioration of renal function. Cisplatin is the agent with the greatest nephrotoxic potential, with a reported incidence of acute kidney injury of approximately 20–30% in different clinical series, although the frequency varies depending on the population studied, the definition used, the administered dose, the type of tumor, the chemotherapy regimen, comorbidities, and the preventive strategies employed (1–4). Carboplatin and oxaliplatin are considered less nephrotoxic than cisplatin; however, they are not without renal toxicity (2, 4, 5). In cohorts that include all three platinum derivatives, the overall incidence of acute kidney disease following chemotherapy has been reported to be approximately 7%, lower than that classically described for cisplatin, but with a relevant prognostic impact on survival (5). Carboplatin nephrotoxicity has been described mainly in relation to high doses, decreased baseline renal function or prior exposure to cisplatin, while oxaliplatin renal injury is less frequent and is usually described in small cases or series, including acute tubular necrosis, acute interstitial nephritis and electrolyte disturbances (2, 4).

Acute kidney injury is defined according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria, which consider any of the following parameters: an increase in serum creatinine ≥ 0.3 mg/dL in

48 hours, an increase ≥ 1.5 times from baseline in the previous seven days, or a decrease in urine output < 0.5 mL/kg/h for at least six hours (6). This classification allows for stratification of severity into three stages and has facilitated comparisons between studies. In the oncology context, its application is particularly important, since even slight increases in creatinine can lead to delays, dose reductions, or discontinuation of potentially effective chemotherapy regimens.

In addition to AKI, the concept of acute kidney disease (AKD) allows for the recognition of functional or structural alterations that persist between 7 and 90 days after an exposure or triggering event. This category is useful in patients treated with chemotherapy, since platinum-induced kidney damage is not always limited to a transient deterioration of creatinine, but can evolve into incomplete recovery, chronic kidney disease or greater vulnerability to new nephrotoxic exposures (7–9).

From a pathophysiological standpoint, cisplatin accumulates primarily in the epithelial cells of the proximal tubule. This process is mediated by transporters such as organic cation transporter 2 (OCT2) and copper transporter 1 (CTR1), with the involvement of efflux systems such as multidrug and toxin extrusion protein 1 (MATE1). Intracellular accumulation promotes mitochondrial dysfunction, oxidative stress, activation of inflammatory pathways, renal vascular injury, apoptosis, and acute tubular necrosis (1, 2, 10). These mechanisms explain the decline in glomerular filtration rate and the development of tubular abnormalities such as hypomagnesemia, hypokalemia, renal solute loss, tubular acidosis, and, in some cases, phenotypes consistent with proximal tubulopathy or Fanconi-like syndrome.

Cisplatin-associated renal damage is dose-dependent and cumulative. Therefore, variables such as dose per body surface area, cumulative dose, number of cycles, interval between administrations, and concomitant administration of other nephrotoxic drugs are relevant for estimating individual risk. Likewise, chemotherapy-induced dehydration, nausea, and vomiting can contribute to hypovolemia and increase the risk of acute kidney injury, particularly in patients with comorbidities or borderline baseline renal function (1, 2, 11, 12).

The clinical magnitude of the problem has been documented in various settings. In outpatients treated with cisplatin, Burns et al. reported an overall incidence of nephrotoxicity of 23.7%, associated with diabetes and a partial protective effect of saline hydration (3). In patients with head and neck cancer treated with high-dose cisplatin, variable incidences of acute kidney injury have been described, predominantly mild stages according to KDIGO, but with an impact on renal function after treatment (8, 11). Fernandes et al. evaluated patients exposed to cisplatin, carboplatin, or oxaliplatin and reported acute kidney injury after chemotherapy in approximately 7% of cases, associated with reduced survival (5).

Factors associated with platinum-induced nephrotoxicity include advanced age, hypertension, diabetes, cardiovascular disease, hypoalbuminemia, impaired baseline renal function, high cisplatin doses, higher cumulative doses, dehydration, nausea or vomiting, concomitant exposure to nephrotoxic agents, and electrolyte imbalances before or during treatment (2–4, 8, 11–13). Some of these factors are potentially modifiable, highlighting the importance of identifying them before and during platinum exposure.

Commonly used preventive strategies include intravenous hydration, magnesium and potassium supplementation, adequate management of emesis, monitoring of creatinine and electrolytes, dose adjustment, and reduction of concomitant nephrotoxic agents (1, 2, 4, 11).

The clinical consequences of platinum-induced nephrotoxicity extend beyond a transient increase in creatinine. Kidney injury can lead to incomplete renal recovery, persistent acute kidney disease, progression to chronic kidney disease, the need for renal replacement therapy, longer hospital stays, interruption or modification of cancer treatment, and increased mortality (5, 7–9, 13, 14). In cancer patients, these consequences are particularly relevant, as the reduction in therapeutic intensity can affect tumor control and overall prognosis.

Despite international evidence, in Mexico and Latin America there is limited information on the frequency, clinical characteristics, associated factors, and outcomes of platinum-induced nephrotoxicity in adults with solid tumors. This gap is significant because the conditions of care, comorbidities, hydration regimens, availability of monitoring, and clinical characteristics of patients may differ from those reported in other countries.

METHODS

Aims: To estimate the frequency of platinum-induced chemotherapy nephrotoxicity, describe the clinical characteristics, and determine the renal and clinical outcomes in adults with solid tumors.

Observational, retrospective, analytical cohort study of cancer patients with solid tumors exposed to platinum-based chemotherapy (cisplatin, carboplatin or oxaliplatin) in a third-level referral hospital in Mexico, over a period of 5 years.

Inclusion criteria

1. ≥ 1 cycle of platinum-based chemotherapy.
2. At least two serum creatinine measurements: baseline and follow-up during the cycle, as well as serum electrolyte measurements.

Exclusion criteria

1. Chronic kidney disease prior to treatment initiation, estimated glomerular filtration rate (eGFR) < 60 mL/min/1.73 m².
2. Prior renal replacement therapy or history of kidney transplantation.
3. Presence of acute kidney injury prior to exposure to the first cycle of platinum-based chemotherapy.

Statistical Analysis

The distribution of quantitative variables was assessed using the Shapiro-Wilk normality test. Normally distributed variables were described using the mean and standard deviation, while non-normally distributed variables were expressed as the median and interquartile range. Qualitative variables were presented using absolute frequencies and percentages. For comparative analysis, patients were classified according to the presence or absence of acute kidney injury as defined by KDIGO criteria. Quantitative variables were compared using the Student's t-test for independent samples and the Mann-Whitney U test, as appropriate. Qualitative variables were analyzed using the chi-square test or Fisher's exact test when expected frequencies were less than five.

Clinically relevant variables and those with an association ($p < 0.20$) in the univariate analysis were included. A $p < 0.05$ value was considered statistically significant. Statistical analysis was performed using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 114 patients with solid tumors treated with platinum-based chemotherapy were included in the study. The mean age was 46.6 ± 15.5 years, and the majority of patients were women (64.9%). Hypertension and type 2 diabetes were present in 23.7% of the cohort, respectively. Concomitant use of angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers was reported in 22.8% of patients, while sodium-glucose symporter type 2 inhibitors (SGLT2i) were used by 13.2%. A history of smoking and alcohol consumption was reported in 43.9% and 44.7% of patients, respectively. Statin therapy was documented in 12.3% of patients, while diuretic use was infrequent (0.9%). No patients were receiving proton pump inhibitors or nonsteroidal anti-inflammatory drugs at baseline (Table 1).

Table 1. Sociodemographic characteristics

Variable	Without AKI (n=78)	AKI (n=36)	p-value
Age, years (DS +/-)	45.8 ± 15.7	48.2 ± 15.3	0.442
Female, n (%)	49 (62.8)	25 (69.4)	0.533
Systemic arterial hypertension, n (%)	17 (21.8)	10 (27.8)	0.487
Type 2 diabetes, n (%)	16 (20.5)	11 (30.6)	0.247
ACE inhibitors/ARBs, n (%)	16 (20.5)	10 (27.8)	0.472
Diuretics, n (%)	0 (0.0)	1 (2.8)	0.316
SGLT2 inhibitors, n (%)	9 (11.5)	6 (16.7)	0.553
History of smoking, n (%)	33 (42.3)	17 (47.2)	0.687
Alcohol consumption, n (%)	35 (44.9)	16 (44.4)	0.999
Statins, n (%)	9 (11.5)	5 (13.9)	0.763
Consumption of toxic substances, n (%)	11 (14.1)	2 (5.6)	0.222

Abbreviations: AKI, acute kidney injury; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor antagonist; SGLT2, sodium-glucose symporter type 2; SD, standard deviation; n, number.

Testicular cancer was the most common neoplasm (29.8%), followed by colon cancer (14.0%), head and neck cancer (13.2%), ovarian cancer (13.2%), rectal cancer (9.6%), bone cancer (7.0%), cholangiocarcinoma (5.3%), bladder cancer (5.3%), lung cancer (1.8%), and endometrial cancer (0.9%) (Table 2).

Table 2. Types of solid tumors

Solid tumor	Without AKI (n=78) n (%)	AKI (n=36) n (%)	p-value
Head and neck cancer	9 (11.5)	6 (16.7)	0.279
Cholangiocarcinoma	2 (2.6)	4 (11.1)	
Colon cancer	11 (14.1)	5 (13.9)	
Endometrial cancer	1 (1.3)	0 (0.0)	
Bone cancer	5 (6.4)	3 (8.3)	
Ovarian cancer	12 (15.4)	3 (8.3)	
Lung cancer	2 (2.6)	0 (0.0)	
Rectal cancer	5 (6.4)	6 (16.7)	
Testicular cancer	27 (34.6)	7 (19.4)	
Bladder cancer	4 (5.1)	2 (5.6)	

Abbreviations: AKI, acute kidney injury; n, number.

Baseline renal function was generally preserved. Baseline serum creatinine before the start of platinum therapy was 0.70 mg/dL (0.60–0.90), while pretreatment serum creatinine was 0.75 mg/dL (0.60–0.90), corresponding to an eGFR by Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) of 109.6 mL/min/1.73 m² (99.4–122.5) (Table 3). At the last dose of chemotherapy, serum creatinine increased to 0.90 mg/dL (0.70–1.10), while the eGFR decreased to 98.2 mL/min/1.73 m² (76.4–115.7) (Table 4).

Pre-treatment urea was 29.7 mg/dL (22.0–38.1) and increased to 35.9 mg/dL (26.4–48.2) after treatment. Serum magnesium decreased from 2.0 mg/dL (1.9–2.1) before treatment to 1.8 mg/dL (1.7–2.0) after platinum exposure (Table 4).

Table 3. Analytical characteristics before the use of platinum chemotherapy

Variable	Without AKI (n=78) (IQR)	AKI (n=36) (IQR)	p-value
Serum creatinine (mg/dL)	0.80 (0.60–0.90)	0.70 (0.60–0.90)	0.466
eGFR (mL/min/1.73 m ²)	110.4 (98.9–120.0)	108.5 (100.3–125.0)	0.833
Urea (mg/dL)	28.2 (22.3–36.1)	33.5 (21.7–39.7)	0.359
Sodium (mEq/L)	138.5 (136.0–140.0)	138.5 (135.5–140.0)	0.854
Potassium (mEq/L)	4.1 (3.9–4.4)	4.1 (3.8–4.3)	0.449
Chloride (mEq/L)	102.5 (100.0–105.0)	102.0 (101.0–105.0)	0.741
Calcium (mg/dL)	9.1 (8.8–9.4)	9.0 (8.8–9.2)	0.371
Phosphorus (mg/dL)	3.75 (3.30–4.00)	3.50 (3.15–3.90)	0.170
Magnesium (mg/dL)	2.0 (1.9–2.1)	2.0 (1.9–2.1)	0.259
Albumin (g/dL)	3.9 (3.5–4.2)	3.8 (3.4–4.1)	0.537

Abbreviations: AKI, acute kidney injury; eGFR, estimated glomerular filtration rate; n, number; IQR, interquartile range.

Table 4. Analytical characteristics after the use of platinum chemotherapy

Variable	Without AKI (n=78) (IQR)	AKI (n=36) (IQR)	p-value
Serum creatinine (mg/dL)	0.80 (0.60–0.90)	1.10 (1.00–1.30)	<0.001
eGFR (mL/min/1.73 m ²)	105.9 (90.6–117.6)	74.4 (61.5–88.6)	<0.001
Urea (mg/dL)	30.8 (25.1–40.2)	47.1 (35.2–56.1)	<0.001
Sodium (mEq/L)	137.0 (136.0–139.0)	138.0 (136.0–139.0)	0.922
Potassium (mEq/L)	4.1 (3.9–4.3)	4.0 (3.6–4.4)	0.531
Chloride (mEq/L)	102.0 (101.0–105.0)	102.0 (100.0–103.0)	0.225
Calcium (mg/dL)	9.0 (8.8–9.2)	9.0 (8.7–9.3)	0.510
Phosphorus (mg/dL)	3.6 (3.3–3.9)	3.4 (3.2–4.0)	0.475
Magnesium (mg/dL)	1.9 (1.7–2.0)	1.7 (1.6–1.9)	0.006

Abbreviations: AKI, acute kidney injury; eGFR, estimated glomerular filtration rate; n, number; IQR, interquartile range.

Cisplatin was the most frequently administered platinum agent (48.2%), followed by carboplatin (26.3%) and oxaliplatin (25.4%). Patients received a median of 5 (4–6) platinum cycles, with the dosage varying according to each agent, with no significant difference between the groups with or without acute kidney injury (Table 5).

Table 5. Platinum chemotherapy cumulative dose

Platinum chemotherapy	Without AKI (n=78) (IQR)	AKI (n=36) (IQR)	p-value
Cisplatin (mg/m ²)	407.6 (348.2–504.7)	356.5 (222.0–517.4)	0.249
Carboplatin (mg)	1,866 (1,400–2,600)	1,600 (1,500–2,356)	0.780
Oxaliplatin (mg/m ²)	720.2 (632.0–906.9)	699.1 (625.1–877.1)	0.909

Abbreviations: AKI, acute kidney injury; n, number; IQR, interquartile range.

Overall, acute kidney injury occurred in 36 patients (31.6%) (Figure 1), while electrolyte disturbances were documented in 40 patients (35.1%) (Figure 2). Renal replacement therapy was required in 9 patients (7.9%), and 8 patients (7.0%) developed chronic kidney disease. Treatment discontinuation occurred in 8 patients (7.0%), while dose modification was required in 13 patients (11.4%). The overall mortality rate was 1.8% (Table 6).

Table 6. Outcomes after the use of platinum chemotherapy

Outcome	Without AKI (n=78) (IQR)	AKI (n=36) (IQR)	p-value
Renal replacement therapy	0 (0.0)	9 (25.0)	<0.001
Chronic kidney disease	2 (2.6)	6 (16.7)	0.012
Treatment discontinuation	0 (0.0)	8 (22.2)	<0.001
Dose modification	3 (3.8)	10 (27.8)	<0.001
Mortality	1 (1.3)	1 (2.8)	0.534

Abbreviations: AKI, acute kidney injury; n, number.

DISCUSSION

In this retrospective cohort of 114 patients with solid tumors who received platinum-based chemotherapy, nearly one-third of the patients developed acute kidney injury despite having preserved baseline renal function and a relatively young age. More importantly, acute kidney injury was strongly

associated with adverse renal and oncologic outcomes, including electrolyte disturbances, chronic kidney disease, renal replacement therapy, chemotherapy dose modification, and treatment discontinuation. These findings suggest that platinum nephrotoxicity remains a significant clinical challenge and emphasize the need to assess kidney injury not only as a renal outcome but also as a determinant of cancer treatment management (2,3,8,15).

The incidence of AKI observed in our study (31.6%) is consistent with contemporary reports describing nephrotoxicity rates ranging from 20% to 35% among patients receiving platinum-based chemotherapy (3,8,12,13,15). However, the clinical significance of our findings lies not only in the frequency of AKI but also in the characteristics of the affected population. Baseline renal function was largely preserved, with a median estimated glomerular filtration rate greater than 100 mL/min/1.73 m², and the mean age was less than 50 years. Thus, the substantial burden of kidney damage observed in our cohort reinforces the concept that platinum exposure itself remains a determinant of nephrotoxicity, even in patients traditionally considered to be at relatively low renal risk.

The most important finding of this study is that platinum-associated AKI was not simply a transient biochemical abnormality, but a clinically significant event with major downstream consequences. Patients who developed AKI had substantially higher rates of renal replacement therapy, chronic kidney disease, chemotherapy dose modification, and treatment discontinuation compared with those who maintained stable renal function. In particular, one-quarter of patients with AKI required renal replacement therapy, approximately one in six developed chronic kidney disease, and more than one in five discontinued chemotherapy. These observations suggest that the clinical burden of platinum nephrotoxicity extends far beyond short-term increases in serum creatinine and can directly influence renal and oncologic outcomes (22-25).

An equally important observation was the impact of AKI on cancer treatment management. Patients who developed AKI were significantly more likely to require chemotherapy dose modification and treatment discontinuation. From an oncology perspective, these findings may be even more relevant than the kidney injury itself. Maintaining treatment intensity and cumulative dose exposure are critical determinants of therapeutic efficacy, particularly in potentially curable neoplasms such as testicular cancer, which represented the largest subgroup in our cohort. Consequently, AKI can negatively affect prognosis not only through kidney-related complications but also through the discontinuation of optimal anticancer therapy (8,22–24).

Another notable finding was the high frequency of electrolyte abnormalities, which exceeded the incidence of creatinine-defined AKI. Furthermore, serum magnesium concentrations were significantly lower among patients who developed AKI. These observations support the concept that platinum nephrotoxicity is characterized by prominent tubular dysfunction and suggest that electrolyte disturbances may identify renal damage that is not fully detected by conventional creatinine-based definitions. Experimental studies have demonstrated preferential accumulation of platinum compounds within proximal tubular epithelial cells via OCT2, leading to mitochondrial dysfunction, oxidative stress,

inflammatory signaling, and tubular cell death (2,15,18,19). From a practical point of view, systematic monitoring of magnesium levels may provide clinically useful information about ongoing tubular toxicity and could help identify patients at increased risk of subsequent kidney damage (20,21).

A notable finding was the absence of independent baseline predictors of AKI. Previous studies have identified age, hypertension, diabetes, hypoalbuminemia, reduced baseline renal function, cumulative cisplatin exposure, and concomitant nephrotoxic medications as important determinants of nephrotoxicity risk (3,12,16,17). However, our population was relatively homogeneous, with preserved baseline renal function and a low burden of comorbidities. Consequently, the absence of statistically significant predictors likely reflects limited statistical power rather than the absence of biologically relevant risk factors. Future multicenter studies with larger sample sizes are needed to validate existing risk prediction models in Latin American populations.

Although mortality did not differ between groups, the overall mortality rate in our cohort was low. This likely reflects the relatively young population, the predominance of curative-intent treatment strategies, and the limited duration of follow-up. Therefore, the absence of a mortality signal should not be interpreted as evidence of benign disease. Instead, our findings suggest that the main burden of platinum nephrotoxicity in this setting lies in treatment discontinuation and long-term renal sequelae—outcomes that can ultimately influence survival but are not adequately captured during short-term follow-up (22–25).

Strengths of this study include the evaluation of a real Latin American population, a region considerably underrepresented in the onconeurology literature; the inclusion of all major platinum compounds in different solid tumor types; and the assessment of clinically relevant outcomes beyond the incidence of AKI. Furthermore, the simultaneous assessment of electrolyte disturbances provides a more comprehensive characterization of platinum nephrotoxicity and better reflects its predominantly tubular phenotype.

Several limitations should be mentioned. First, the retrospective, single-center design limits causal inference and introduces the possibility of residual confounding. Second, the modest sample size restricted the statistical power for identifying risk factors and comparing platinum agents. Third, reliance on serum creatinine likely underestimated subclinical tubular injury, especially given the delayed rise in creatinine following platinum exposure (2,15,26). Fourth, treatment regimens, supportive care strategies, and hydration protocols may have influenced the results. Finally, the relatively short follow-up period limited the assessment of long-term renal outcomes and survival.

In summary, these findings support a proactive onconeurological approach that incorporates structured monitoring of renal function and electrolytes, aggressive correction of magnesium deficiency, and early intervention by a nephrologist when nephrotoxicity develops. Future prospective, multicenter studies including biomarkers of tubular injury and longer follow-up are needed to refine risk stratification and optimize renal-protective strategies in patients receiving platinum-based chemotherapy.

CONCLUSION

Acute kidney injury remains a frequent complication of platinum-based chemotherapy, affecting nearly one-third of patients despite preserved baseline renal function and a low burden of traditional renal risk factors. Platinum nephrotoxicity is characterized not only by a reduction in glomerular filtration rate but also by prominent tubular dysfunction, manifested by frequent electrolyte imbalances and magnesium loss.

It is important to note that the main clinical consequence of nephrotoxicity in this population was the interruption of cancer treatment, including dose reduction and treatment discontinuation, along with an increased risk of chronic kidney disease and renal replacement therapy. These findings highlight the need for systematic renal monitoring, early detection of tubular injury, and the implementation of renal-protective strategies aimed at preserving both renal function and the intensity of cancer treatment.

Abbreviations

AKI

acute kidney injury

DNA

deoxyribonucleic acid

KDIGO

Kidney Disease:Improving Global Outcomes

AKD

acute kidney disease

OCT2

organic cation transporter 2

CTR1

copper transporter 1

MATE1

multidrug and toxin extrusion protein 1

eGFR

estimated glomerular filtration rate

CKD-EPI

Chronic Kidney Disease Epidemiology Collaboration

ACEI

angiotensin-converting enzyme inhibitor

ARB

angiotensin II receptor antagonist

SGLT2

sodium-glucose symporter type 2

SD

standard deviation

N

number

IQR

interquartile range

Declarations

Ethics approval and consent to participate

The study was approved by the institutional ethics committee of Hospital General de México "Dr. Eduardo Liceaga", and was conducted in accordance with the Declaration of Helsinki.

Written informed consent was obtained from all participants

Consent for publication

Not applicable.

Availability of data and materials

Original datasets in this study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no competing interests.

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Authors' Contributions

A.D.S., J.D.D.G., and R.C.B.C. conceptualized the study, developed the methodology, and conducted the research. J.D.D.G. and F.M.S. performed the data analysis. J.D.D.G., A.D.S., A.C.N., E.G.H., E.J.A.R.R., A.C.N., J.D.F.M., J.C.D.N., and A.S.M.S. drafted the manuscript. A.D.S. and J.D.D.G. organized the data. J.D.D.G., A.D.S., A.C.N., E.G.H., E.J.A.R.R., A.V.N., J.D.F.M., J.C.D.N., and A.S.M.S. They reviewed the manuscript. All authors reviewed and approved the final version of the manuscript.

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References

1. Zhang J, Ye ZW, Tew KD, Townsend DM. Cisplatin chemotherapy and renal function. *Adv Cancer Res.* 2021;152:305–27. 10.1016/bs.acr.2021.03.008.
2. Lyrio RMC, Rocha BRA, Corrêa ALRM, Mascarenhas MGS, Santos FL, Maia RH, et al. Chemotherapy-induced acute kidney injury: epidemiology, pathophysiology, and therapeutic approaches. *Front Nephrol.* 2024;4:1436896. 10.3389/fneph.2024.1436896.
3. Burns CV, Edwin SB, Szpunar S, Forman J. Cisplatin-induced nephrotoxicity in an outpatient setting. *Pharmacotherapy.* 2021;41(2):184–90. 10.1002/phar.2500.
4. Shahrahmani F, Badamchizadeh S, Kaihani F, Alavi-Moghadam S, Keshtkari S, Rezaei-Tavirani M, et al. Platinum-based chemotherapies-induced nephrotoxicity: mechanisms, potential treatments, and management. *Int Urol Nephrol.* 2025;57(6):1563–83. 10.1007/s11255-024-04303-2.
5. Fernandes ARDS, de Brito GA, Baptista AL, Andrade LAS, Imanishe MH, Pereira BJ. The influence of acute kidney disease on the clinical outcomes of patients who received cisplatin, carboplatin, and oxaliplatin. *Health Sci Rep.* 2022;5(1):e479. 10.1002/hsr2.479.
6. Kidney Disease. Improving Global Outcomes (KDIGO) Acute Kidney Injury Work Group. KDIGO clinical practice guideline for acute kidney injury. *Kidney Int Suppl.* 2012;2(1):1–138.
7. Chawla LS, Bellomo R, Bihorac A, Goldstein SL, Siew ED, Bagshaw SM, et al. Acute kidney disease and renal recovery: consensus report of the Acute Disease Quality Initiative (ADQI) 16 Workgroup. *Nat Rev Nephrol.* 2017;13(4):241–57. 10.1038/nrneph.2017.2.
8. Trevisani F, Di Marco F, Quattrini G, Lepori N, Floris M, Valsecchi D, et al. Acute kidney injury and acute kidney disease in high-dose cisplatin-treated head and neck cancer. *Front Oncol.* 2023;13:1173578. 10.3389/fonc.2023.1173578.
9. Renaghan AD, Ostermann M, Ronco C, Ballen K, Cosmai L, Fenoglio R, et al. The nephrotoxic effects of anti-cancer therapies: consensus report of the 34th Acute Disease Quality Initiative workgroup. *Nat Rev Nephrol.* 2026;22(4):283–300. 10.1038/s41581-025-01031-3.
10. Volarevic V, Djokovic B, Gazdic Jankovic M, Harrell CR, Fellabaum C, Djonov V, et al. Molecular mechanisms of cisplatin-induced nephrotoxicity: a balance on the knife edge between renoprotection and tumor toxicity. *J Biomed Sci.* 2019;26(1):25. 10.1186/s12929-019-0518-9.
11. Van der Vorst MJDL, Neefjes ECW, Toffoli EC, Oosterling-Jansen JEW, Vergeer MR, Leemans CR, et al. Incidence and risk factors for acute kidney injury in head and neck cancer patients treated with concurrent chemoradiation with high-dose cisplatin. *BMC Cancer.* 2019;19(1):1066. 10.1186/s12885-019-6233-9.
12. Liu JQ, Cai GY, Wang SY, Song YH, Xia YY, Liang S, et al. The characteristics and risk factors for cisplatin-induced acute kidney injury in the elderly. *Ther Clin Risk Manag.* 2018;14:1279–85. 10.2147/TCRM.S165531.
13. Wondm SA, Dagne SB, Dagne FN, Tarekegn GY, Moges TA, Abebe RB, et al. Cisplatin-based chemotherapy-induced nephrotoxicity and its impact on the survival status of patients with gynecological cancer in Ethiopia: a multicenter retrospective cohort study. *Sci Afr.* 2025;28:e02666. 10.1016/j.sciaf.2025.e02666.

14. Latcha S, Jaimes EA, Patil S, Glezerman IG, Mehta S, Flombaum CD. Long-term renal outcomes after cisplatin treatment. *Clin J Am Soc Nephrol*. 2016;11(7):1173–9. 10.2215/CJN.08070715.
15. Tang C, Livingston MJ, Safirstein R, Dong Z. Cisplatin nephrotoxicity: new insights and therapeutic implications. *Nat Rev Nephrol*. 2023;19(1):53–72. 10.1038/s41581-022-00631-7.
16. Motwani SS, McMahon GM, Humphreys BD, Partridge AH, Waikar SS, Curhan GC. Development and Validation of a Risk Prediction Model for Acute Kidney Injury After the First Course of Cisplatin. *J Clin Oncol*. 2018;36(7):682–8. 10.1200/JCO.2017.75.7161.
17. Gupta S, Glezerman IG, Hirsch JS, et al. Derivation and external validation of a simple risk score for predicting severe acute kidney injury after intravenous cisplatin: cohort study. *BMJ*. 2024;384:e077169. 10.1136/bmj-2023-077169. Published 2024 Mar 27.
18. Miller RP, Tadagavadi RK, Ramesh G, Reeves WB. Mechanisms of Cisplatin nephrotoxicity. *Toxins (Basel)*. 2010;2(11):2490–518. 10.3390/toxins2112490.
19. Ozkok A, Edelstein CL. Pathophysiology of cisplatin-induced acute kidney injury. *Biomed Res Int*. 2014;2014:967826. 10.1155/2014/967826.
20. Hamroun A, Lenain R, Bigna JJ, et al. Prevention of Cisplatin-Induced Acute Kidney Injury: A Systematic Review and Meta-Analysis. *Drugs*. 2019;79(14):1567–82. 10.1007/s40265-019-01182-1.
21. Crona DJ, Faso A, Nishijima TF, McGraw KA, Galsky MD, Milowsky MI. A Systematic Review of Strategies to Prevent Cisplatin-Induced Nephrotoxicity. *Oncologist*. 2017;22(5):609–19. 10.1634/theoncologist.2016-0319.
22. Rosner MH, Perazella MA. Acute Kidney Injury in Patients with Cancer. *N Engl J Med*. 2017;376(18):1770–81. 10.1056/NEJMra1613984.
23. Kitchlu A, McArthur E, Amir E, et al. Acute Kidney Injury in Patients Receiving Systemic Treatment for Cancer: A Population-Based Cohort Study. *J Natl Cancer Inst*. 2019;111(7):727–36. 10.1093/jnci/djy167.
24. Rosner MH, Jhaveri KD, McMahon BA, Perazella MA. Onconeurology: The intersections between the kidney and cancer. *CA Cancer J Clin*. 2021;71(1):47–77. 10.3322/caac.21636.
25. Christiansen CF, Johansen MB, Langeberg WJ, Fryzek JP, Sørensen HT. Incidence of acute kidney injury in cancer patients: a Danish population-based cohort study. *Eur J Intern Med*. 2011;22(4):399–406. 10.1016/j.ejim.2011.05.005.
26. Vaidya VS, Ozer JS, Dieterle F, et al. Kidney injury molecule-1 outperforms traditional biomarkers of kidney injury in preclinical biomarker qualification studies. *Nat Biotechnol*. 2010;28(5):478–85. 10.1038/nbt.1623.

Figures

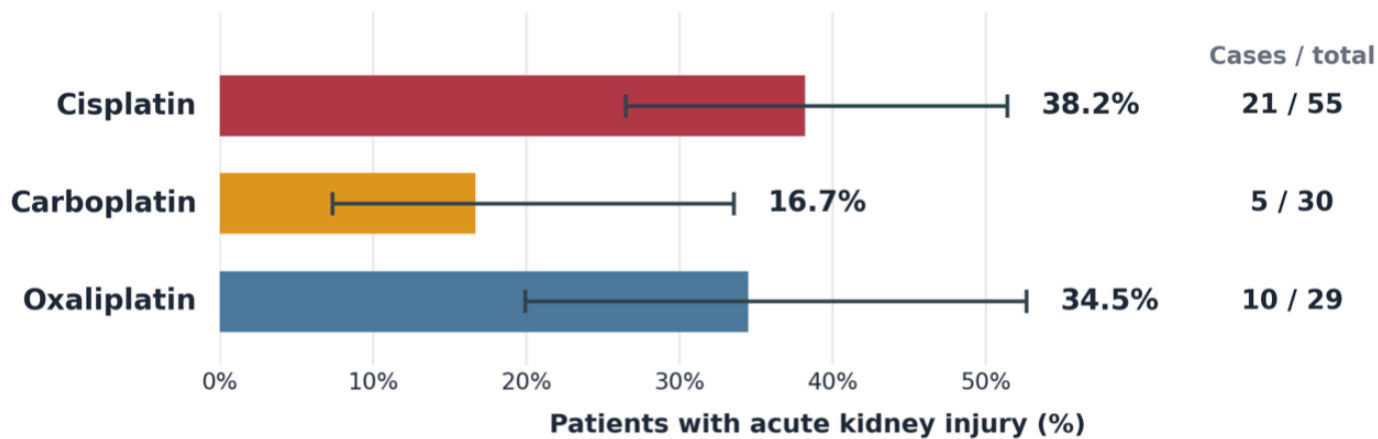


Figure 1

Frequency of acute kidney injury after the use of platinum chemotherapy

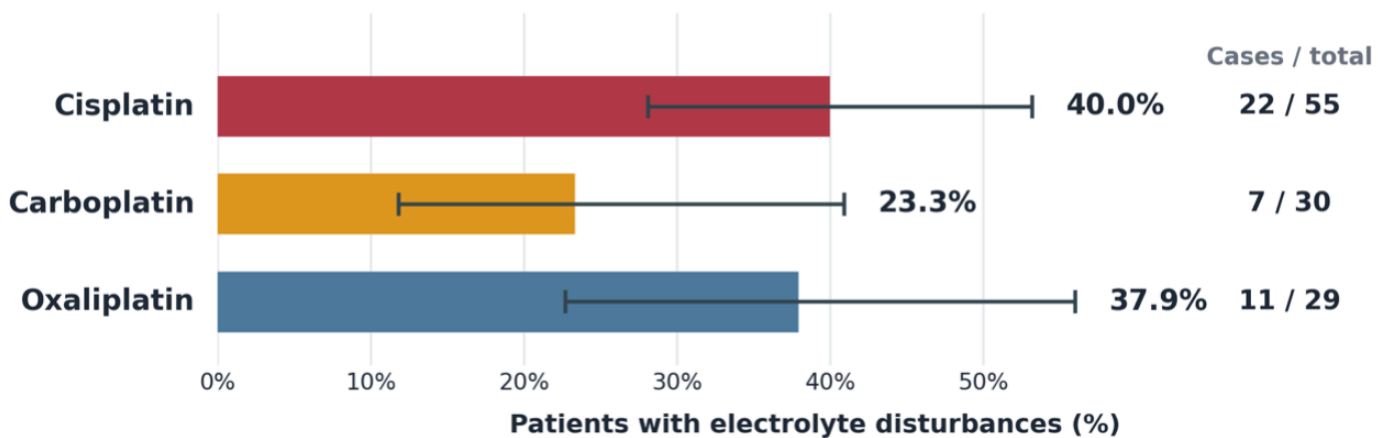


Figure 2

Frequency of electrolytic disturbances after the use of platinum chemotherapy