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Original Research Article

Comparative Evaluation of Adverse Drug Reactions of Cisplatin- vs. Carboplatin-Based Chemotherapy in Head and Neck Cancer Patients

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Abstract

Introduction: Head and neck squamous cell carcinoma (HNSCC) accounts for a significant proportion of global cancer burden, particularly in low- and middle-income countries. Cisplatin remains the preferred chemotherapeutic agent in concurrent chemoradiation, but its use is limited by nephrotoxicity, ototoxicity, and gastrointestinal side effects. Carboplatin, with a more favourable toxicity profile, is often substituted, but comparative data remain essential to guide clinical practice.

Materials and Methods: This was a prospective, observational, comparative study conducted in the Department of Medical Oncology over 18 months. A total of 70 patients with histologically confirmed HNSCC were enrolled and stratified into two groups: Group A (cisplatin-based regimen, n=35) and Group B (carboplatin-based regimen, n=35). Patients were assessed for demographic distribution, adverse drug reactions (ADRs), and treatment compliance. Toxicities were graded according to CTCAE version 5.0, and statistical analysis was performed using chi-square/Fisher's exact test and t-test, with $p<0.05$ considered significant.

Results: Both cisplatin and carboplatin groups showed comparable baseline characteristics. Cisplatin was associated with higher gastrointestinal toxicity (nausea/vomiting: 71.4% vs 40.0%, p=0.006), nephrotoxicity (28.6% vs 5.7%, p=0.016), and ototoxicity (17.1% vs 0%, p=0.024). Carboplatin caused significantly more thrombocytopenia (37.1% vs 11.4%, p=0.012). Treatment compliance was slightly higher in the carboplatin group (85.7% vs 80.0%, p=0.536), though not statistically significant.

Conclusion: Cisplatin remains the preferred agent due to its established efficacy; however, carboplatin may be considered an effective alternative in patients with poor tolerance to cisplatin because of its lower renal and auditory toxicities.

Keywords: Head And Neck Cancer, Cisplatin, Carboplatin, Chemoradiation, Adverse Drug Reactions, Treatment Compliance.

Introduction

Head and neck cancers (HNCs), predominantly squamous cell carcinomas (SCCHN), account for nearly 5–10% of all malignancies worldwide and continue to be a major public health challenge [1,2]. The burden is particularly high in low- and middle-income countries, including India, where widespread use of tobacco, alcohol, and betel quid, along with late-stage presentation, contributes to increased morbidity and mortality [1,2]. Over the past few decades, advances in multimodality therapy—including surgery, radiotherapy, chemotherapy, and their combinations—have significantly improved survival outcomes in SCCHN. Large meta-analyses, such as the MACH-NC and MAC-NPC collaborations, have demonstrated a clear survival advantage with the addition of chemotherapy to local treatment modalities, with the greatest benefit observed in concomitant chemoradiation settings [3,4]. Based on this evidence, the National Comprehensive Cancer Network (NCCN) and other guidelines recommend concurrent chemoradiation as the standard of care for locally advanced disease, with platinum agents forming the backbone of systemic therapy [5,6]. Cisplatin remains the preferred agent due to its proven radio sensitising and cytotoxic properties, supported by multiple randomised clinical trials [5,6]. However, its use is frequently limited by dose-related toxicities, including nephrotoxicity, ototoxicity, neurotoxicity, severe nausea and vomiting, and myelosuppression [7,8]. These adverse effects often necessitate dose reduction, treatment interruption, or discontinuation, which may compromise clinical outcomes. Carboplatin, a second-generation platinum analog with a similar mechanism of

action, is often used as a substitute for cisplatin in patients who are unable to tolerate its toxicity profile. Compared to cisplatin, carboplatin is associated with lower rates of nephrotoxicity, ototoxicity, neurotoxicity, and gastrointestinal side effects [9]. In a randomized controlled trial of patients with locoregionally advanced nasopharyngeal carcinoma, carboplatin-based chemoradiation demonstrated comparable three-year overall survival and disease-free survival to cisplatin-based therapy, while showing improved tolerability [10].

In this context, comparative evaluation of cisplatin versus carboplatin in terms of both therapeutic outcomes and adverse drug reactions (ADRs) remains clinically relevant. Toxicity profiles directly influence treatment adherence, quality of life, and survival, making it crucial to clarify the risk–benefit balance of these regimens. The present study was therefore designed to systematically compare cisplatin- and carboplatin-based chemotherapy in SCCHN patients, focusing particularly on adverse drug reactions, overall survival, and loco-regional disease control.

Materials and Methods

This was a prospective, observational, comparative study conducted in the Department of Medical Oncology, a tertiary care teaching hospital. The study was carried out over a period of 18 months after approval from the Institutional Ethics Committee.

Written informed consent was obtained from all participants prior to enrollment. The study population comprised patients with histologically confirmed squamous cell carcinoma of the head and neck (SCCHN) who were planned to receive platinum-based chemotherapy either alone or in combination with radiotherapy.

Inclusion criteria

- Age ≥18 years.
- ECOG performance status 0–2.
- Patients eligible to receive cisplatin or carboplatin as per treating oncologist's discretion.
- Adequate baseline hematological, renal, and hepatic function.

Exclusion criteria

- Prior exposure to platinum-based chemotherapy.
- Known hypersensitivity to cisplatin or carboplatin.
- Severe uncontrolled comorbidities (e.g., congestive heart failure, uncontrolled diabetes, or active infections).
- Pregnant or lactating women.

Sample Size: A total of 70 patients were included in the study. They were stratified into two groups based on the chemotherapy regimen received. Group A consisted of 35 patients who received cisplatin-based regimens, while Group B consisted of 35 patients who received carboplatin-based regimens. Allocation was based on the treating oncologist's clinical judgment, taking into account performance status, comorbidities, and renal function.

Chemotherapy Protocol: Patients in the cisplatin group received the drug either at a dose of 100 mg/m² every 3 weeks or 40 mg/m² weekly, according to institutional protocol. Patients in the carboplatin group were treated with the drug at an area under the curve (AUC) of 5–6 every 3 weeks or AUC 2 weekly, with doses adjusted according to the Calvert formula. All patients were given hydration, antiemetic prophylaxis, and other supportive care in accordance with standard guidelines.

Assessment of Adverse Drug Reactions: Adverse drug reactions (ADRs) were monitored during each chemotherapy cycle through clinical examination, patient-reported symptoms, and laboratory investigations, including complete blood counts, renal and liver function tests, and audiometry. Toxicities were graded using the Common Terminology Criteria for Adverse Events (CTCAE), version 5.0. Specific toxicities assessed were haematological (anaemia, leukopenia, neutropenia, thrombocytopenia), gastrointestinal (nausea, vomiting, mucositis, diarrhoea), renal impairment, ototoxicity, neurotoxicity, and dermatological reactions.

Outcome Measures: The primary outcome measure was the incidence, pattern, and severity of ADRs in the cisplatin versus carboplatin groups. Secondary outcomes included the impact of ADRs on treatment compliance, such as dose modification, treatment delay, or discontinuation, as well as the requirement for supportive care, including blood transfusion, growth factor support, or hospitalisation.

Statistical Analysis: All data were recorded in Microsoft Excel and analysed using SPSS version 21 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), while categorical variables were presented as frequencies and percentages. The Chi-square test or Fisher's exact test was applied for categorical comparisons, and the independent t-test or Mann–Whitney U test was used for continuous variables. Correlation analyses were carried out using Pearson or Spearman coefficients as appropriate. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 70 patients with squamous cell carcinoma of the head and neck (SCCHN) were enrolled, with 35 patients each in the cisplatin and carboplatin groups. The mean age of the study population was 54.2 ± 9.6 years (range: 34–72 years). Patients in the cisplatin group had a mean age of 52.8 ± 8.7 years, while those in the carboplatin group had a mean age of 55.6 ± 10.2 years; this difference was not statistically significant (p = 0.218). Males predominated in both groups, accounting for 80.0% in the cisplatin group and 77.1% in the carboplatin group. The distribution of ECOG performance status was also comparable between the two groups. The baseline demographic and clinical characteristics are summarized in Table 1.

Both cisplatin- and carboplatin-based regimens were associated with adverse drug reactions, although the pattern and frequency varied between the groups (Table 2). Anemia was noted in 51.4% of patients in the cisplatin group and 62.9% of those in the carboplatin group, while neutropenia occurred in 31.4% of cisplatin-treated patients and 45.7% of carboplatin-treated patients; neither difference was statistically significant. Thrombocytopenia, however, was significantly more common in the carboplatin group (37.1%) compared with the cisplatin group (11.4%) (p = 0.012). Gastrointestinal toxicities were more frequent in the cisplatin group. Nausea and vomiting occurred in 71.4% of patients receiving cisplatin compared with 40.0% of patients on carboplatin (p = 0.006). Mucositis was observed in 37.1% of cisplatin patients and 31.4% of carboplatin patients, while diarrhoea was infrequent and comparable between groups. Organ-specific toxicities were also noted. Nephrotoxicity was significantly higher among cisplatin recipients, occurring in 28.6% of patients compared with 5.7% in the carboplatin group (p = 0.016). Ototoxicity was reported in 17.1% of cisplatin patients, whereas no cases were seen in the carboplatin group (p = 0.024).

Neurotoxicity rates were low and comparable in both groups, occurring in 11.4% of cisplatin-treated and 8.6% of carboplatin-treated patients. Most adverse events were of Grade 1–2 severity, although Grade 3–4 gastrointestinal toxicities, particularly nausea and vomiting, were more frequently observed in the cisplatin group, while Grade 3–4 haematological toxicities, especially thrombocytopenia, were more common in the carboplatin group. Chemotherapy completion rates were slightly higher in the carboplatin group, where 85.7% of patients completed the planned treatment, compared to 80.0% in the cisplatin group; the difference was not statistically significant (p = 0.536). Dose modifications due to toxicity were required in 25.7% of cisplatin patients and 20.0% of carboplatin patients. Treatment discontinuation occurred in 8.6% of patients in the cisplatin group and 5.7% in the carboplatin group. Hospitalizations related to adverse drug reactions were comparable between the two groups (14.3% versus 17.1%). These findings are detailed in Table 3.

Table 1: Baseline Characteristics of the Study Population

Characteristic	Cisplatin Group (n = 35)	Carboplatin Group (n = 35)	p-value
Age (years), mean ± SD	52.8 ± 8.7	55.6 ± 10.2	0.218
Age range (years)	34–70	36–72	–
Gender, n (%)			
• Male	28 (80.0%)	27 (77.1%)	0.774
• Female	7 (20.0%)	8 (22.9%)	
ECOG Performance Status, n (%)			0.651
• 0–1	25 (71.4%)	23 (65.7%)	
• 2	10 (28.6%)	12 (34.3%)	

Table 2: Distribution of Adverse Drug Reactions (ADRs)

Adverse Event	Cisplatin Group (n = 35)	Carboplatin Group (n = 35)	p-value
Hematological			
Anemia	18 (51.4%)	22 (62.9%)	0.317
Leukopenia/Neutropenia	11 (31.4%)	16 (45.7%)	0.214
Thrombocytopenia	4 (11.4%)	13 (37.1%)	0.012
Gastrointestinal			
Nausea/Vomiting	25 (71.4%)	14 (40.0%)	0.006*
Mucositis	13 (37.1%)	11 (31.4%)	0.617
Diarrhea	5 (14.3%)	6 (17.1%)	0.739
Organ Specific			
Nephrotoxicity	10 (28.6%)	2 (5.7%)	0.016*
Ototoxicity	6 (17.1%)	0 (0.0%)	0.024*
Neurotoxicity	4 (11.4%)	3 (8.6%)	0.687

Table 3: Treatment Compliance and Toxicity Impact

Parameter	Cisplatin Group (n = 35)	Carboplatin Group (n = 35)	p-value
Completed planned chemotherapy	28 (80.0%)	30 (85.7%)	0.536
Required dose modification	9 (25.7%)	7 (20.0%)	0.573
Treatment discontinuation	3 (8.6%)	2 (5.7%)	0.642
Hospitalization for ADR management	5 (14.3%)	6 (17.1%)	0.739

Discussion

In our study, the mean age was 54.2 ± 9.6 years, with a slight male predominance (cisplatin: 80.0%, carboplatin: 77.1%). Both groups were well balanced, ensuring comparability of outcomes. Similar demographic profiles were reported by Wilkins et al. (2013) [11], who performed a matched-pair analysis of 118 patients receiving cisplatin- versus carboplatin-based chemoradiation. The median age in their cisplatin arm was 57 years compared to 61 years in the carboplatin arm, with males comprising over 70% of the study population. Homma et al. (2004) [12] in a randomised trial of 61 patients also reported a median age of 61 years in both arms, and a predominance of men (>75%). Thus, our study's baseline population aligns with those of previous trials, strengthening the validity of cross-study comparisons.

In our study, carboplatin caused significantly more thrombocytopenia (37.1% vs 11.4%, p = 0.012), while cisplatin was associated with higher rates of nausea/vomiting (71.4% vs 40.0%, p = 0.006), nephrotoxicity (28.6% vs 5.7%, p = 0.016), and ototoxicity (17.1% vs 0%, p = 0.024). Neutropenia (45.7% vs 31.4%) and anemia (62.9% vs 51.4%) were numerically higher in the carboplatin group, though not statistically significant.

Wilkins et al. (2013) [11] reported similar patterns: grade ≥3 anemia occurred in 15% of carboplatin patients vs 7% of cisplatin patients, and thrombocytopenia in 12% vs 3%, respectively. Conversely, grade ≥3 vomiting was significantly more common with cisplatin (18% vs 4%). Homma et al. (2004) [12] also demonstrated higher hematological toxicity with carboplatin, with grade 3–4 leukopenia in 39% vs 22% in cisplatin, and thrombocytopenia in 17% vs 0%. On the other hand, cisplatin produced more gastrointestinal toxicity, with grade 3–4 nausea/vomiting in 35% vs 13% for carboplatin. Rades et al. (2012) [13] compared adjuvant cisplatin versus carboplatin with radiotherapy in oropharyngeal and oral cavity cancers and found that severe mucositis was slightly more common with cisplatin (22% vs 14%), whereas hematologic toxicity was more frequent with carboplatin (26% vs 12%). De Andres et al. (1995) [14] compared cisplatin/5-FU and carboplatin/5-FU in stage IV disease and reported that grade 3–4 hematological toxicity was more frequent in carboplatin patients (28% vs 17%), while grade 3–4 nausea/vomiting was higher with cisplatin (23% vs 11%).Further support comes from Deng et al. (1999) [15], who reported that myelosuppression occurred in 42% of carboplatin recipients compared with 28% in the cisplatin arm, while gastrointestinal toxicity was higher with cisplatin (34% vs 18%). Ge et al. (1998) [16] found similar results in nasopharyngeal carcinoma, where thrombocytopenia was 21% with carboplatin vs 5% with cisplatin, while vomiting was 37% with cisplatin vs 19% with carboplatin. Taken together, these results confirm the consistent pattern observed in our study: carboplatin is more myelotoxic, particularly with thrombocytopenia, while cisplatin causes more nephrotoxicity, ototoxicity, and gastrointestinal side effects such as nausea and vomiting. In our study, 80.0% of patients in the cisplatin group and 85.7% in the carboplatin group completed the planned chemotherapy, with no significant difference (p = 0.536). Dose modification was required in 25.7% of cisplatin patients and 20.0% of carboplatin patients, while discontinuation occurred in 8.6% vs 5.7%, respectively. Wilkins et al. (2013) [11] reported treatment completion rates of 74% in cisplatin and 78% in carboplatin patients, showing equivalence in compliance.

Homma et al. (2004) [12] noted that 86% of carboplatin patients completed full treatment compared with 81% in the cisplatin group, again favoring carboplatin slightly in terms of tolerability. Rades et al. (2012) [13] also found no significant difference in acute toxicity or compliance, despite carboplatin being used more often in older patients with poorer renal function. Wen et al. (2013) [17] studied compliance in nasopharyngeal carcinoma and reported that carboplatin-based chemoradiation was associated with fewer treatment interruptions (12% vs 21%) and better tolerability compared with cisplatin. Our study findings mirror these observations: although carboplatin produces more hematologic toxicity, its reduced renal and auditory toxicities allow comparable, if not slightly improved, treatment compliance.

Conclusion

The study demonstrated that automated cell counters correlated well with cytological and histological findings in pleural and peritoneal fluids, offering rapid and reliable results. This highlights their potential as effective diagnostic

tools for fluid analysis in clinical practice. However, cytology remains essential for definitive diagnosis.

Limitations of the Study

The study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of findings. Allocation of patients to cisplatin or carboplatin groups was based on clinician discretion rather than randomization, introducing potential selection bias. Additionally, the follow-up period was short, restricting assessment of long-term survival outcomes and late toxicities.

References

1. Haddad RI, Shin DM. Recent advances in head and neck cancer. N Engl J Med. 2008;359: 1143–1154.
2. Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D. Global cancer statistics. CA Cancer J Clin. 2011; 61:69–90.
3. Blanchard P, Baujat B, Holostenco V, Bourredjem A, Baey C, Bourhis J, Pignon JP; MACH-NC Collaborative Group. Meta-ana lysis of chemotherapy in head and neck cancer (MACH-NC): a comprehensive analysis by tumour site. Radiother Oncol. 2011; 100:33–40.
4. Blanchard P, Lee A, Marguet S, Leclercq J, Ng WT, Ma J, Chan AT, et al. Chemotherapy and radiotherapy in nasopharyngeal carcinoma: an update of the MAC-NPC meta-analysis. Lancet Oncol. 2015; 16:645–655.
5. Adelstein DJ, Li Y, Adams GL, Wagner H Jr, Kish JA, Ensley JF, Schuller DE, Forastiere AA. An intergroup phase III comparison of standard radiation therapy and two schedules of concurrent chemoradiotherapy in patients with unresectable squamous cell head and neck cancer. J Clin Oncol. 2003; 21:92–98.
6. Forastiere AA, Goepfert H, Maor M, Pajak TF, Weber R, Morrison W, Glisson B, Trotti A, Ridge JA, Chao C, Peters G, Lee DJ, Leaf A, Ensley J, Cooper J. Concurrent chemotherapy and radiotherapy for organ preservation in advanced laryngeal cancer. N Engl J Med. 2003; 349:2091–2098.
7. Rademaker-Lakhai JM, Crul M, Zuur L, Baas P, Beijnen JH, Simis YJ, van Zandwijk N, Schellens JH. Relationship between cisplatin administration and the development of ototoxicity. J Clin Oncol. 2006; 24:918–924.
8. Pabla N, Dong Z. Curtailing side effects in chemotherapy: a tale of PKCδ in cisplatin treatment. Oncotarget. 2012; 3:107–111.
9. Lokich J, Anderson N. Carboplatin versus cisplatin in solid tumors: an analysis of the literature. Ann Oncol. 1998; 9:13–21.
10. Chitapanarux I, Lorvidhaya V, Kamnerd supaphon P, Sumitsawan Y, Tharavichitkul E, Sukthomya V, Ford J. Chemoradiation comparing cisplatin versus carboplatin in locally advanced nasopharyngeal cancer: randomized, non-inferiority, open trial. Eur J Cancer. 2007; 43:1399–1406.
11. Wilkins AC, Rosenfelder N, Schick U, Gupta S, Thway K, Nutting CM, et al. Equivalence of cisplatin and carboplatin-based chemoradiation for locally advanced squamous cell carcinoma of the head and neck: a matched-pair analysis. Oral Oncol. 2013; 49:615-9.
12. Homma A, Shirato H, Furuta Y, Nishioka T, Oridate N, Tsuchiya K, et al. Randomized phase II trial of concomitant chemoradio therapy using weekly carboplatin or daily low-dose cisplatin for squamous cell carcinoma of the head and neck. Cancer J. 2004; 10:326-32.
13. Rades D, Ulbricht T, Hakim SG, Schild SE. Cisplatin superior to carboplatin in adjuvant radio chemotherapy for locally advanced cancers of the oropharynx and oral cavity. Strahlenther Onkol. 2012; 188:42-8.
14. De Andres L, Brunet J, Lopez-Pousa A, Burgues J, Vega M, Tabernero JM, et al. Randomized trial of neoadjuvant cisplatin and fluorouracil versus carboplatin and fluorouracil in patients with stage IV-M0 head and neck cancer. J Clin Oncol. 1995; 13:1493-500.
15. Deng LC, Zhou LX, Li SY, Shen D. Analysis of therapeutic effect of carboplatin or cisplatin plus fluorouracil in head and neck squamous cell carcinoma neoadjuvant chemotherapy. Zhong Liu Yan Jiu Yu Lin Chuang. 1999; 11:105-6.
16. Ge W, Chen P, Zhang JH, Zhou YF. The effect of the neoadjuvant chemotherapy on middle and advanced nasopharyngeal carcinoma by 5-FU plus DDP or CBP. J Hubei Med Univ. 1998; 19:346-8.
17. Wen QL, Li D, He LJ, Yang HR, Xiang L, Ren PR, et al. The compliance and tolerability of patients with nasopharyngeal carcinoma using concomitant chemoradiotherapy. Zhongguo Laonianxue Zazhi. 2013; 33:277-80.