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Chemotherapy-Induced Hypertension: Risk Factors, Monitoring, and Management Strategies

Mr.AnoopJ,Research Scholar, Malwanchal University, Indore

Prof Dr Pradeep VS, Research Supervisor, Malwanchal University, Indore

Abstract

Chemotherapy-induced hypertension (C-HTN) has emerged as a prevalent complication in cancer treatment, particularly with the advent of targeted therapies such as VEGF inhibitors, tyrosine kinase inhibitors (TKIs), proteasome inhibitors, and others. This review examines the underlying risk factors, mechanisms, clinical monitoring strategies, and management protocols. It synthesizes current evidence and guidelines, focusing on optimizing cardiovascular and oncologic outcomes through tailored approaches that balance antihypertensive therapy with oncologic efficacy.

1. Introduction

Advances in cancer therapies have greatly improved survival but introduced cardiovascular toxicities, notably chemotherapy-induced hypertension (C-HTN). This phenomenon is increasingly recognized across diverse therapy classes—including angiogenesis inhibitors, proteasome inhibitors, and hormonal agents—and contributes significantly to cancer-related morbidity and mortality (Arriola-Montenegro et al., 2025) (MDPI).

2. Risk Factors & Epidemiology

2.1 Prevalence in Cancer Patients

Hypertension is commonly encountered in cancer populations. One review reports a general prevalence of ~37% in registry data, while childhood cancer survivors exhibit hypertension exceeding 70% by age 50 (Zhu & Wu, 2022; Cohen et al., 2019) (PMC). Another source indicates that 30% of all cancer-treated patients have comorbid hypertension, with therapy-induced cases potentially necessitating discontinuation of chemotherapy (Abi Aad et al., 2015) (ScienceDirect).

2.2 Pharmacologic Risk Factors

- **VEGF pathway inhibitors**: VEGF inhibitors introduce hypertension in nearly all patients, with incidence ranging from 20% to 90%, dependent on agent potency and dosage (Cohen et al., 2023) (American Heart Association Journals).
- **Tyrosine kinase inhibitors**: Agents like sunitinib, sorafenib, and axitinib carry high risk, with varying prevalence influenced by dose dependence (Guo et al., 2021) (Frontiers).
- **Proteasome inhibitors & others**: Carfilzomib, ibrutinib, copanlisib, and agents targeting androgen signaling (abiraterone, enzalutamide) are all implicated (Zhu & Wu, 2022) (PMC).
- **Combination therapies**: Meta-analysis shows that combination regimens elevate hypertension risk significantly (All-grade risk ratio ~2.85; grade 3–4 up to ~4.37) compared to monotherapy or control (Guo et al., 2021) (Frontiers).

3. Pathophysiology

3.1 Mechanisms Specific to Cancer Therapies

- **VEGF inhibition**: Leads to reduced nitric oxide (NO) bioavailability, elevated endothelin-1, and enhanced salt retention via ENaC activation—all fostering increased vascular resistance and blood pressure (Askarinejad et al., 2023; Zhu & Wu, 2022) (BioMed Central).
- **TKIs & non-VEGF agents**: Ibrutinib, for example, is associated with a nearly threefold increase in high-grade hypertension (RR ~2.82), likely via PI3K/Akt inhibition and NO suppression (Zhu & Wu, 2022) (PMC).
- **Renal dysfunction**: Contributory role in C-HTN due to nephrotoxicity from agents or treatment-related insults like tumor lysis and sepsis (Arriola-Montenegro et al., 2025) (MDPI).

3.2 Patient- and Disease-Related Factors

Common cardiovascular risk factors such as age, obesity, diabetes, pain, anxiety, and steroid or erythropoietin use may compound blood pressure elevation (Zhu & Wu, 2022) (PMC).

4. Monitoring & Diagnosis

4.1 Blood Pressure Assessment in Oncology

C-HTN diagnosis mirrors general practice, using thresholds of ≥130/80 mmHg per ACC/AHA guidelines; however, ambulatory monitoring is preferred for better prognostic accuracy, especially with intermittent therapy schedules (Zhu & Wu, 2022) (PMC). Home blood pressure monitoring (HBPM) and telehealth systems show promise in early detection (Zhu & Wu, 2022) (PMC).

4.2 Early and Active Monitoring Phase

Initiation of BP monitoring—especially during the first chemotherapy cycle—is crucial, as most cases emerge early (Mouhayar et al., 2011) (PMC).

4.3 Contextual Evaluation

A comprehensive assessment must distinguish primary from secondary hypertension, evaluating triggers like pain, IV fluids, anxiety, and drug timing (Zhu & Wu, 2022) (PMC).

5. Management Strategies

5.1 Blood Pressure Targets

- General goal: <130/80 mmHg (ACC/AHA) (PMC).
- Specific adjustments: For metastatic or asymptomatic patients, ESC suggests more relaxed targets of 140–160/90–100 mmHg depending on comorbidities (Askarinejad et al., 2023) (BioMed Central).

5.2 Pharmacologic Treatments

- **First-line options**:
  - ACE inhibitors or ARBs are generally preferred, especially in VEGF inhibitor settings, and show potential survival benefits in renal cell carcinoma (Zhu & Wu, 2022) (PMC).
  - Dihydropyridine calcium channel blockers (like amlodipine) are viable alternatives (Askarinejad et al., 2023) (BioMed Central).
- **Avoided or cautionary agents**:
  - Non-dihydropyridine CCBs (verapamil/diltiazem) should be avoided due to CYP3A4 interactions that may raise oncologic drug levels

(Askarinejad et al., 2023; Mohammed et al., 2021) (Frontiers, BioMed Central).

- For androgen pathway inhibitors like abiraterone, eplerenone may be preferred and spironolactone avoided (Zhu & Wu, 2022) (PMC).
- Beta-blockers may be helpful for proteasome inhibitors or BTK inhibitors, with caution in those where heart rate–raising medications are to be avoided (Zhu & Wu, 2022) (PMC).

5.3 Therapeutic Adjustments

For uncontrolled hypertension, clinicians may need to interrupt or reduce chemotherapy dosage, especially for VEGF inhibitors like bevacizumab (Mohammed et al., 2021) (BioMed Central).

5.4 Integrated and Tailored Care

Multidisciplinary management—including oncologists, cardiologists, and primary physicians—is essential. Therapy should be individualized based on etiology, comorbidities, and treatment goals (Arriola-Montenegro et al., 2025) (MDPI).

6. Practical Guidelines & Expert Consensus

6.1 Oncology-Specific Recommendations

The UK consensus on bevacizumab in ovarian/cervical cancer provides structured guidance for pre-, during, and post-therapy BP management to avoid treatment disruption (Plummer et al., 2019) (Nature).

6.2 Cardio-Oncology Guidance

Cardio-oncology protocols integrate ESC/ESH guidelines for hypertension but adapt target thresholds and drug choices for cancer patients (Askarinejad et al., 2023) (BioMed Central).

7. Future Directions & Research Needs

- Evidence gaps persist for optimal antihypertensive strategies in oncology contexts (Zhu & Wu, 2022) (PMC).
- Prospective trials are needed to validate hypertension as a biomarker of cancer therapy efficacy (Zhu & Wu, 2022) (PMC).
- Digital health tools for home monitoring and telemedicine should be further explored (Zhu & Wu, 2022) (PMC).

8. Conclusion

Chemotherapy-induced hypertension is common and multifaceted, driven by both treatment-related and patient-specific factors. Careful monitoring, accurate diagnosis, and tailored pharmacologic intervention are critical to maintain both oncologic efficacy and cardiovascular safety. Continued research and multidisciplinary collaboration are required to refine guidelines and improve outcomes for cancer patients facing this complication.

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