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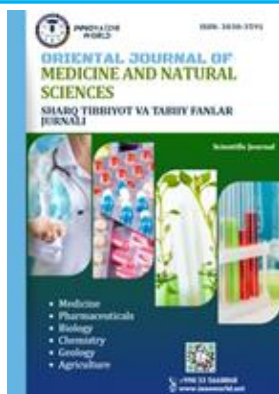
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Drug-Induced Pancytopenia from Non-Chemotherapy Agents: A Review of Current Evidence and the Need for Standardized Monitoring Guidelines

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Annotatsiya: Ushbu maqolada kimyoterapiya bilan bog'liq bo'lmagan dorilar ta'sirida yuzaga keluvchi pansitopeniya holatlari tahlil qilinadi. Antibiotiklar, immunosuppressiv va yurak-qon tomir dorilari kabi vositalar bilan bog'liq qon hujayralari kamayishi mexanizmlari, klinik belgilari hamda monitoringdagi kamchiliklar yoritilgan. Tadqiqotda turli holatlar tahlili asosida shifokorlar uchun erta aniqlash va oldini olishga qaratilgan tavsiyalar ishlab chiqilgan.

Kalit so'zlar: Pansitopeniya, dori-induksiya, qon tahlili, nazorat protokoli, toksiklik, farmakovigilans, profilaktika.

Abstract

Drug-induced pancytopenia is a potentially life-threatening condition that can result from various medications, including non-chemotherapy agents such as antibiotics, immunosuppressants, and cardiovascular drugs. Despite its severity, many cases are diagnosed only after significant clinical deterioration, often due to the absence of routine blood monitoring protocols. This review aims to synthesize the current literature on pancytopenia induced by non-chemotherapy drugs, identify key risk factors, and highlight the critical gap in standardized complete blood count (CBC) monitoring practices. Based on case reports and pharmacovigilance data, we propose a risk-based approach to guide clinicians in early detection and prevention.

1. Introduction

Pancytopenia, defined as the reduction of all three major blood cell lines—red blood cells, white blood cells, and platelets—can arise from various causes, including infections, malignancies, autoimmune diseases, and drug toxicity. While chemotherapy-induced pancytopenia is well-characterized and routinely monitored, pancytopenia associated with non-chemotherapy drugs is often overlooked. In recent years, numerous case reports have highlighted reversible but severe episodes of pancytopenia due to drugs like amiodarone, trimethoprim-sulfamethoxazole (TMP-SMX), ceftriaxone, and azathioprine. The lack of a standardized approach to monitoring these agents leads to delayed diagnosis and increased morbidity.

2. Mechanisms of Drug-Induced Pancytopenia

The mechanisms by which non-chemotherapy drugs cause pancytopenia are varied and often poorly understood. Common mechanisms include:

- Direct myelotoxicity: e.g., TMP-SMX may cause dose-dependent marrow suppression.
- Immune-mediated destruction: e.g., methimazole or bupropion can trigger autoantibody-mediated cell destruction.
- Idiosyncratic hypersensitivity: unpredictable reactions not related to dose or duration.
- Drug-drug interactions: e.g., azathioprine toxicity amplified by allopurinol co-administration.

These mechanisms underscore the importance of early detection, as pancytopenia may develop even with standard dosages and normal renal or hepatic function.

3. Clinical Presentation and Diagnosis

Pancytopenia typically presents with non-specific symptoms such as fatigue, pallor, infections, and bleeding tendencies. Laboratory tests confirm the diagnosis:

- Decreased hemoglobin, leukocytes, and platelets
- Bone marrow biopsy may show hypocellularity, granulomas, or dysplastic changes
- No unified diagnostic algorithm is available to determine drug causality conclusively.

Case reports consistently show that symptoms often precede diagnosis due to lack of routine CBC monitoring.

5. The Current Gap in Monitoring Guidelines

Unlike chemotherapy agents, which follow strict hematologic monitoring schedules (e.g., weekly CBCs), most non-chemotherapy drugs lack:

- Standard CBC baseline testing before starting therapy
- Recommended intervals for CBC follow-up
- Awareness among clinicians about hematologic risks
- Label warnings or guidance from regulatory bodies (e.g., FDA, EMA)

This results in reactive management, where treatment begins only after pancytopenia is evident, often with dangerous consequences.

7. Conclusion

Drug-induced pancytopenia from non-chemotherapy agents is a preventable but under-recognized cause of hematologic toxicity. The consistent delay in diagnosis due to absent or irregular CBC monitoring underscores a significant gap in current clinical practice. There is an urgent need for:

- Greater clinician awareness
- Risk-stratified monitoring protocols
- Regulatory recommendations for high-risk drugs

Future studies should aim to develop validated monitoring algorithms and assess their impact on outcomes in real-world settings.

4. Review of Key Case Reports

Several published case reports highlight the issue of delayed recognition due to the absence of routine CBC monitoring.

Author/Year	Drug	Monitoring	Onset	Outcome
Tummala et al., 2021	Amiodarone	No	~3 weeks	Reversible after withdrawal
Mittal et al., 2018	TMP-SMX	No	~7 days	Recovered after stopping
Koneru et al., 2022	Ceftriaxone	No	10 days	Full recovery
Kim et al., 2021	Azathioprine + Allopurinol	No	2 weeks	Hospitalized, recovered
Tahir et al., 2020	Bupropion	No	~2–4 weeks	Severe neutropenia

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