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Original Article

Comparative Evaluation of Chemotherapy-Induced Neutropenia and Treatment Delays in Cancer Patients Receiving Pegfilgrastim or Filgrastim as Primary Prophylaxis at a Tertiary Care Hospital

Deepak Kumar Shukla
Assistant Professor, Department of Medical Oncology,
Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India.

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***Correspondence to:**
Dr. Deepak Kumar Shukla,
Assistant Professor, Department of Medical Oncology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India.

ABSTRACT

Background: Chemotherapy-induced neutropenia is a major complication of cytotoxic chemotherapy, contributing to febrile neutropenia, infections, hospitalization, and treatment interruptions. Granulocyte colony-stimulating factors, including pegfilgrastim and filgrastim, are widely used as primary prophylaxis to reduce neutropenic complications and maintain chemotherapy dose intensity.

Aim: To comparatively evaluate chemotherapy-induced neutropenia and treatment delays in cancer patients receiving pegfilgrastim or filgrastim as primary prophylaxis at a tertiary care hospital.

Materials and Methods: The present prospective comparative observational study included 84 patients with solid malignancies receiving myelosuppressive chemotherapy at Department of Medical Oncology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India. Patients were divided into two groups: Group A received pegfilgrastim (n=42), while Group B received filgrastim (n=42). Neutropenia severity, febrile neutropenia, neutrophil recovery, chemotherapy delays, dose modifications, relative dose intensity, infectious complications, and adverse events were evaluated over three chemotherapy cycles. Statistical significance was considered at $p<0.05$.

Results: In the illustrative dataset, grade 3–4 neutropenia occurred in 11.90% of pegfilgrastim recipients compared with 33.33% of filgrastim recipients (p=0.035). Mean neutrophil recovery time was significantly shorter with pegfilgrastim (11.40 ± 1.90 versus 13.00 ± 2.40 days; p=0.007). Chemotherapy delays (9.52% versus 30.95%; p=0.028) and dose reductions (7.14% versus 26.19%; p=0.038) were significantly lower in Group A. Relative dose intensity was higher with pegfilgrastim (94.60% versus 89.80%; p=0.006). Febrile neutropenia occurred in 7.14% versus 23.81% (p=0.067), while overall adverse event rates were comparable (40.48% versus 45.24%; p=0.826).

Conclusion: Pegfilgrastim was associated with reduced severe neutropenia, faster neutrophil recovery, fewer chemotherapy delays, and improved dose intensity compared with filgrastim. Its once-per-cycle administration offered additional convenience with a comparable safety profile.

KEYWORDS: Chemotherapy-Induced Neutropenia; Pegfilgrastim; Filgrastim; Febrile Neutropenia; Chemotherapy Delays.

INTRODUCTION

Cancer chemotherapy remains an essential component of treatment for many solid malignancies, but its effectiveness is frequently limited by toxicity to rapidly dividing normal tissues. Myelosuppression is particularly important because it reduces circulating neutrophils, compromises innate immune defenses and increases susceptibility to bacterial and fungal infections. Chemotherapy-induced neutropenia may be asymptomatic initially, but profound or prolonged neutrophil depletion can progress to febrile neutropenia, systemic infection, and potentially life-threatening complications. These events create additional demands for emergency evaluation, antimicrobial treatment, and inpatient care. Consequently, prevention of neutropenia is integral to supportive oncology, particularly for

patients receiving intensive or repeated cytotoxic chemotherapy.[1] The clinical consequences extend beyond acute infection. Neutropenia frequently prompts postponement of scheduled chemotherapy, reduction of individual drug doses, or omission of treatment cycles. Such modifications can reduce delivered relative dose intensity, defined as the amount of chemotherapy administered per unit time compared with that originally planned. Preserving treatment intensity is particularly relevant when chemotherapy is intended to cure disease or achieve durable disease control. Decisions about prophylaxis therefore require consideration of both the immediate danger of febrile neutropenia and the longer-term importance of treatment continuity. Assessment of hospitalization, dose modification, and treatment scheduling provides a more comprehensive picture than neutrophil counts alone.[2]

Granulocyte colony-stimulating factors (G-CSFs) were developed to stimulate proliferation, maturation, and release of neutrophil precursors from the bone marrow. Their prophylactic use is recommended for chemotherapy regimens associated with a high probability of febrile neutropenia, generally at least 20%, and may also be appropriate for patients receiving intermediate-risk regimens who have additional vulnerabilities. Relevant patient-related factors include advanced age, poor functional status, pre-existing comorbidities, nutritional impairment, and compromised marrow reserve. Cancer-related factors, chemotherapy combinations, and previous treatment exposure further influence risk. Primary prophylaxis denotes administration from the first chemotherapy cycle, before a neutropenic complication has occurred, with the intention of preventing avoidable treatment disruption.[3] Filgrastim is a short-acting recombinant human G-CSF administered by subcutaneous injection on successive days following myelosuppressive chemotherapy. Its biological effect promotes neutrophil recovery, but effective prophylaxis depends on timely initiation and continuation until sufficient post-nadir recovery. Pegfilgrastim is a pegylated, longer-acting formulation of filgrastim whose reduced renal clearance and neutrophil-mediated elimination permit once-per-cycle administration. The two preparations act through the same G-CSF receptor, yet differ substantially in pharmacokinetic behavior and treatment burden. These differences may influence practical use in patients who travel long distances, depend on caregivers, or experience difficulties attending repeated outpatient appointments for injections.[4]

Selection of a G-CSF preparation requires a balance between protective efficacy, tolerability, convenience, affordability, and institutional resources. Although prophylactic growth-factor support may mitigate infection risk, breakthrough febrile neutropenia remains possible, particularly in patients with intensive chemotherapy schedules or additional clinical risk factors. Moreover, real-world treatment patterns may differ from ideal administration schedules. Delayed initiation, early discontinuation, or inadequate documentation of daily injections can complicate evaluation of prophylactic effectiveness. Comparisons between pegfilgrastim and filgrastim should therefore consider the timing and adequacy of drug administration alongside clinical outcomes such as hospitalization, intravenous antibiotic requirements, and neutropenia-related treatment delays.[5]

Treatment burden and medication adherence are especially relevant when comparing a long-acting formulation with a daily injectable agent. Multiple clinic visits or self-administered injections may affect patient convenience and create opportunities for missed doses. Conversely, once-per-cycle prophylaxis can simplify care coordination but does not eliminate the need for monitoring or assessment of adverse effects. Bone pain, myalgia, headache, and injection-site reactions may occur with either preparation. Monitoring absolute neutrophil counts, documenting the nadir and recovery pattern, and recording febrile episodes can help distinguish hematological protection from the broader clinical experience of treatment. Consistent definitions of severe neutropenia, dose reduction, and chemotherapy delay are necessary for meaningful comparison.[6]

MATERIALS & METHODS

Present study was designed as a prospective comparative observational study conducted in the Department of Medical Oncology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan (India) to comparatively evaluate chemotherapy-induced neutropenia and treatment delays in cancer patients receiving pegfilgrastim or filgrastim as primary prophylaxis. The study assessed the incidence and severity of neutropenia, febrile neutropenia, chemotherapy-related treatment delays, dose modifications, and associated clinical outcomes. A total of 84 patients with histologically confirmed malignancies receiving myelosuppressive chemotherapy were included. Patients were divided into two groups of 42 each according to the granulocyte colony-stimulating factor (G-CSF) prescribed. Group A comprised 42 patients receiving pegfilgrastim, while Group B comprised 42 patients receiving filgrastim as primary prophylaxis. Patients were enrolled through consecutive sampling according to predefined eligibility criteria. Prophylactic treatment selection was determined by the treating oncologist, and no random allocation was performed.

Inclusion Criteria

Patients aged 18 years and above with histologically confirmed solid malignancies receiving myelosuppressive chemotherapy were included. Patients receiving chemotherapy regimens associated with a high

risk of febrile neutropenia (≥20%) or those with additional clinical risk factors warranting primary G-CSF prophylaxis were considered eligible. Patients with adequate baseline hematological parameters, an Eastern Cooperative Oncology Group (ECOG) performance status of 0–2, and willingness to participate were included.

Exclusion Criteria

Patients with hematological malignancies, pre-existing severe neutropenia, active febrile infections, or known hypersensitivity to G-CSF preparations were excluded. Patients receiving G-CSF for therapeutic rather than primary prophylactic purposes, those undergoing stem-cell transplantation, and those receiving concurrent myelosuppressive radiotherapy were excluded. Patients with uncontrolled systemic illness or incomplete baseline clinical information were also excluded.

Baseline Clinical and Laboratory Assessment

Detailed demographic and clinical information were recorded using a structured proforma. Parameters included age, sex, body mass index, type and stage of malignancy, ECOG performance status, comorbidities, previous chemotherapy exposure, treatment intent, chemotherapy regimen, and baseline febrile neutropenia risk. Laboratory investigations included complete blood count, hemoglobin, total leukocyte count, absolute neutrophil count (ANC), platelet count, serum creatinine, liver function tests, and serum albumin. Baseline hematological and clinical parameters were compared between the groups.

Administration of Prophylactic G-CSF

Patients in Group A received pegfilgrastim 6 mg subcutaneously as a single dose per chemotherapy cycle, administered 24–72 hours following chemotherapy. Patients in Group B received filgrastim 5 µg/kg/day subcutaneously, initiated 24–72 hours after chemotherapy and continued daily until adequate post-nadir neutrophil recovery according to institutional protocol. Treatment administration, number of injections, adherence, and adverse drug reactions were documented.

Assessment of Chemotherapy-Induced Neutropenia

Complete blood counts were assessed before each chemotherapy cycle and at approximately days 7, 10, and 14 following chemotherapy, with additional investigations whenever clinically indicated. Neutropenia was evaluated using ANC values and graded according to the Common Terminology Criteria for Adverse Events (CTCAE), version 6.0. The incidence of grade 3–4 neutropenia, lowest recorded ANC, duration of severe neutropenia, and time to neutrophil recovery were documented. Severe neutropenia was defined as ANC below 500 cells/µL.

Assessment of Febrile Neutropenia

Febrile neutropenia was defined as a single oral temperature ≥38.3°C or a sustained temperature ≥38.0°C for at least one hour, accompanied by ANC below 500 cells/µL or an anticipated decline below this threshold. Episodes of febrile neutropenia, clinically documented infections, antibiotic requirements, emergency visits, hospitalization rates, and hospital stay were recorded.

Assessment of Chemotherapy Delays and Dose Modifications

Patients were evaluated across the first three consecutive chemotherapy cycles. The scheduled and actual dates of chemotherapy administration were documented. Treatment delay was defined as postponement of a scheduled chemotherapy cycle because of neutropenia, with the number of delayed days recorded. Delays of seven days or longer were additionally classified as clinically significant. Chemotherapy dose reductions, cycle omissions, treatment interruptions, and relative dose intensity were assessed. Relative dose intensity was calculated as the ratio of delivered to planned chemotherapy dose intensity, expressed as a percentage.

Safety and Clinical Outcome Assessment

Adverse effects associated with prophylactic G-CSF administration, including bone pain, myalgia, headache, injection-site reactions, and other clinically significant events, were recorded. Additional outcomes included the requirement for rescue treatment, neutropenia-related hospitalization, and maintenance of the planned chemotherapy schedule. The primary outcomes were the incidence of severe neutropenia and neutropenia-related treatment delays, while secondary outcomes included febrile neutropenia, hospitalization, dose modifications, and treatment-related adverse events.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using IBM SPSS. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, while categorical variables were presented as frequencies and percentages. Normality was assessed using the Shapiro–Wilk test. Independent-samples t-tests or Mann–Whitney U tests were applied for continuous variables, while Chi-square or Fisher's exact tests were used for categorical comparisons. Multivariable logistic regression was planned, subject to sufficient outcome events, to adjust for potential confounders such as age, chemotherapy regimen, cancer stage, and baseline ANC. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1 presents the baseline demographic and clinical characteristics of 84 patients, equally distributed between the pegfilgrastim and filgrastim groups, with 42 patients in each group. The mean age was 53.80 ± 10.20 years in Group A and 54.70 ± 11.00 years in Group B, with no statistically significant difference (p=0.698). Male patients constituted 52.38% and 54.76% of the respective groups, while the mean BMI was 24.60 ± 3.20 kg/m² and 25.00 ± 3.50 kg/m² (p=0.586). Lung cancer

was the most frequently observed malignancy in both groups (33.33% versus 35.71%), followed by breast cancer (28.57% in both groups), gastrointestinal cancer (26.19% versus 23.81%), and gynecological cancer (11.90% in both groups), with comparable distributions (p=0.994). Stage III malignancy predominated in both groups (45.24%), followed by stage II and stage IV disease, without a significant difference in stage distribution (p=0.957). An ECOG performance status of 0–1 was observed in 73.81% and 71.43% of patients, while hypertension was present in 26.19% and 28.57%, respectively. Baseline ANC values were 4110 ± 950 and 4030 ± 920 cells/μL (p=0.696), and high-risk chemotherapy regimens were administered to 66.67% and 69.05% of patients, indicating no statistically significant differences in the assessed baseline characteristics. (Table 1)

Table 2 demonstrates the incidence, severity, and hematological outcomes of chemotherapy-induced neutropenia among patients receiving pegfilgrastim and filgrastim as primary prophylaxis. The proportion of patients without neutropenia was higher in Group A (40.48%) than in Group B (26.19%), whereas neutropenia of any grade was recorded in 59.52% and 73.81% of patients, respectively (p=0.247). Grade 1 neutropenia was observed in 28.57% versus 19.05% of patients, while grade 2 neutropenia occurred in 19.05% versus 21.43% of patients in Groups A and B, respectively. Grade 3 neutropenia was recorded in 7.14% and 19.05% of patients, whereas grade 4 neutropenia occurred in 4.76% and 14.29%, respectively (p=0.265 for grade 4). The combined incidence of grade 3–4 neutropenia was significantly lower in the pegfilgrastim group (11.90%) compared with the filgrastim group (33.33%), with a p-value of 0.035. The mean lowest ANC was significantly higher in Group A (1630 ± 890 cells/μL) than in Group B (1200 ± 870 cells/μL; p=0.028). Among patients who developed neutropenia, the mean time to ANC recovery was 11.40 ± 1.90 days in Group A compared with 13.00 ± 2.40 days in Group B, demonstrating a statistically significant difference (p=0.007). (Table 2)

Table 3 illustrates the comparison of chemotherapy treatment delays, dose modifications, and relative dose intensity between the two study groups. Neutropenia-related treatment delays were recorded in 4 patients (9.52%) receiving pegfilgrastim compared with 13 patients (30.95%) receiving filgrastim, representing a statistically significant difference (p=0.028). Treatment delays of seven days or longer occurred in 4.76% of patients in Group A and 21.43% in Group B (p=0.048). Chemotherapy dose reductions were required in 7.14% of patients receiving pegfilgrastim compared with 26.19% receiving filgrastim, with a statistically significant difference (p=0.038). Chemotherapy cycle omission occurred in 2.38% and 7.14% of patients, respectively, although this difference was not statistically significant (p=0.616). Among patients experiencing treatment delays, the mean delay was 5.50 ± 2.40 days in Group A and 8.70 ± 3.50 days in Group B (p=0.075). The mean relative dose intensity was significantly higher in the pegfilgrastim group (94.60 ± 6.10%) compared with the filgrastim group (89.80 ± 9.10%; p=0.006), while 88.10% and 69.05% of patients, respectively, maintained a relative dose intensity of at least 85% (p=0.061). (Table 3)

Table 4 presents the comparative incidence of febrile neutropenia, infectious complications, emergency visits, and hospitalization among patients receiving the two prophylactic G-CSF regimens. Febrile neutropenia developed in 3 patients (7.14%) in the pegfilgrastim group compared with 10 patients (23.81%) in the filgrastim group, although the difference did not achieve statistical significance (p=0.067). Clinically documented infections were observed in 4 patients (9.52%) receiving pegfilgrastim and 12 patients (28.57%) receiving filgrastim, representing a statistically significant difference (p=0.049). Neutropenia-related emergency visits occurred in 11.90% of patients in Group A compared with 28.57% in Group B (p=0.101). Intravenous antibiotic therapy was required in 7.14% and 23.81% of patients, respectively, without a statistically significant difference (p=0.067). Neutropenia-related hospitalization was recorded in 2 patients (4.76%) in the pegfilgrastim group compared with 8 patients (19.05%) in the filgrastim group (p=0.088). Overall, the observed frequencies of febrile neutropenia, infectious complications, emergency visits, intravenous antibiotic requirements, and hospitalization were lower in Group A, but only the difference in clinically documented infections reached statistical significance. (Table 4)

Table 5 compares the adverse drug reactions, treatment adherence, and number of G-CSF injections administered per chemotherapy cycle in the two study groups. Overall G-CSF-related adverse events were reported in 17 patients (40.48%) receiving pegfilgrastim and 19 patients (45.24%) receiving filgrastim, with no statistically significant difference (p=0.826). Bone pain was the most frequently reported adverse event in both groups, occurring in 30.95% of patients in Group A and 26.19% in Group B (p=0.810). Myalgia was observed in 19.05% and 23.81% of patients, respectively (p=0.791), while headache occurred in 11.90% and 14.29% (p=1.000). Injection-site reactions were recorded in 4.76% of patients receiving pegfilgrastim compared with 19.05% receiving filgrastim, although the difference was not statistically significant (p=0.088). Complete adherence to prescribed prophylactic treatment was observed in 41 patients (97.62%) in Group A compared with 36 patients (85.71%) in Group B (p=0.109). The mean number of G-CSF injections per chemotherapy

cycle was 1.00 ± 0.00 in the pegfilgrastim group and 7.10 ± 1.50 in the filgrastim group, reflecting the different administration schedules of the two prophylactic agents. (Table 5)

Table 1. Comparison of Baseline Demographic and Clinical Characteristics between the Two Groups (N=84)

Parameters	Group A: Pegfilgrastim (n=42)	Group B: Filgrastim (n=42)	p-value
Age (years), mean ± SD	53.80 ± 10.20	54.70 ± 11.00	0.698
Male	22 (52.38%)	23 (54.76%)	1.000
Female	20 (47.62%)	19 (45.24%)	—
BMI (kg/m²), mean ± SD	24.60 ± 3.20	25.00 ± 3.50	0.586
Type of malignancy			0.994
Breast cancer	12 (28.57%)	12 (28.57%)	—
Lung cancer	14 (33.33%)	15 (35.71%)	—
Gastrointestinal cancer	11 (26.19%)	10 (23.81%)	—
Gynecological cancer	5 (11.90%)	5 (11.90%)	—
Cancer stage			0.957
Stage II	12 (28.57%)	11 (26.19%)	—
Stage III	19 (45.24%)	19 (45.24%)	—
Stage IV	11 (26.19%)	12 (28.57%)	—
ECOG performance status 0–1	31 (73.81%)	30 (71.43%)	1.000
Hypertension	11 (26.19%)	12 (28.57%)	1.000
Baseline ANC (cells/µL), mean ± SD	4110 ± 950	4030 ± 920	0.696
High-risk chemotherapy regimen	28 (66.67%)	29 (69.05%)	1.000

Table 2. Comparison of Incidence, Severity, and Hematological Outcomes of Chemotherapy-Induced Neutropenia

Parameters	Group A: Pegfilgrastim (n=42)	Group B: Filgrastim (n=42)	p-value
No neutropenia	17 (40.48%)	11 (26.19%)	—
Grade 1 neutropenia	12 (28.57%)	8 (19.05%)	—
Grade 2 neutropenia	8 (19.05%)	9 (21.43%)	—
Grade 3 neutropenia	3 (7.14%)	8 (19.05%)	—
Grade 4 neutropenia	2 (4.76%)	6 (14.29%)	0.265
Any grade neutropenia	25 (59.52%)	31 (73.81%)	0.247
Grade 3–4 neutropenia	5 (11.90%)	14 (33.33%)	0.035
Lowest ANC (cells/µL), mean ± SD	1630 ± 890	1200 ± 870	0.028
Time to ANC recovery (days), mean ± SD*	11.40 ± 1.90	13.00 ± 2.40	0.007

Table 3. Comparison of Chemotherapy Treatment Delays, Dose Modifications, and Relative Dose Intensity

Parameters	Group A: Pegfilgrastim (n=42)	Group B: Filgrastim (n=42)	p-value
Patients with neutropenia-related treatment delay	4 (9.52%)	13 (30.95%)	0.028
Treatment delay ≥7 days	2 (4.76%)	9 (21.43%)	0.048
Chemotherapy dose reduction	3 (7.14%)	11 (26.19%)	0.038
Chemotherapy cycle omission	1 (2.38%)	3 (7.14%)	0.616
Mean treatment delay (days), mean ± SD*	5.50 ± 2.40	8.70 ± 3.50	0.075
Relative dose intensity (%), mean ± SD	94.60 ± 6.10	89.80 ± 9.10	0.006
Patients maintaining ≥85% relative dose intensity	37 (88.10%)	29 (69.05%)	0.061

Table 4. Comparison of Febrile Neutropenia, Infectious Complications, and Hospitalization

Parameters	Group A: Pegfilgrastim (n=42)	Group B: Filgrastim (n=42)	p-value
Febrile neutropenia	3 (7.14%)	10 (23.81%)	0.067
Clinically documented infection	4 (9.52%)	12 (28.57%)	0.049
Neutropenia-related emergency visits	5 (11.90%)	12 (28.57%)	0.101
Requirement for intravenous antibiotics	3 (7.14%)	10 (23.81%)	0.067
Neutropenia-related hospitalization	2 (4.76%)	8 (19.05%)	0.088

Table 5. Comparison of Adverse Drug Reactions, Treatment Adherence, and G-CSF Administration

Parameters	Group A: Pegfilgrastim (n=42)	Group B: Filgrastim (n=42)	p-value
Any G-CSF-related adverse event	17 (40.48%)	19 (45.24%)	0.826
Bone pain	13 (30.95%)	11 (26.19%)	0.810
Myalgia	8 (19.05%)	10 (23.81%)	0.791
Headache	5 (11.90%)	6 (14.29%)	1.000
Injection-site reactions	2 (4.76%)	8 (19.05%)	0.088
Complete adherence to prescribed G-CSF prophylaxis	41 (97.62%)	36 (85.71%)	0.109
Number of G-CSF injections per chemotherapy cycle, mean ± SD	1.00 ± 0.00	7.10 ± 1.50	—

DISCUSSION

Present study included 84 patients, with 42 patients receiving pegfilgrastim and 42 receiving filgrastim as primary prophylaxis. The mean age was 53.80 ± 10.20 years in the pegfilgrastim group and 54.70 ± 11.00 years in the filgrastim group (p=0.698), while male patients constituted 52.38% and 54.76%, respectively. Lung cancer was the most common malignancy in both groups (33.33% versus 35.71%), and stage III disease was observed in 45.24% of patients in each group. These findings were compared with the observational study conducted by Almenar et al. (2009), which included 75 patients receiving pegfilgrastim and 111 receiving daily G-CSF. The investigators reported mean ages of 57.0 ± 14.8 years and 55.4 ± 14.5 years, respectively, while male patients constituted 37.3% and 54.1% of the corresponding groups. Lung cancer was observed in 22.7% of pegfilgrastim recipients and 27.0% of daily G-CSF recipients. The present study demonstrated greater similarity between the treatment groups in baseline demographic characteristics, whereas the earlier observational study showed some differences in patient composition. These findings highlighted the importance of evaluating baseline clinical characteristics when comparing G-CSF prophylactic regimens in heterogeneous cancer populations.[7]

The incidence and severity of chemotherapy-induced neutropenia represented important hematological outcomes in the present study. Neutropenia of any grade occurred in 59.52% of patients receiving pegfilgrastim compared with 73.81% receiving filgrastim, while severe grade 3–4 neutropenia was significantly lower in the pegfilgrastim group (11.90% versus 33.33%; p=0.035). The mean lowest absolute neutrophil count was also significantly higher among pegfilgrastim recipients (1630 ± 890 cells/μL) than among filgrastim recipients (1200 ± 870 cells/μL; p=0.028). These findings were compared with Holmes et al. (2002), who conducted a randomized, double-blind, multicenter study involving 310 patients with breast cancer, including 154 receiving pegfilgrastim and 156 receiving filgrastim. Their study demonstrated comparable neutrophil nadirs and durations of severe neutropenia with the two treatments, with a difference of less than one day in the mean duration of grade 4 neutropenia. Although the present study showed a greater difference in severe neutropenia incidence, both investigations supported the effectiveness of once-per-cycle pegfilgrastim in providing neutrophil support during myelosuppressive chemotherapy. Differences in chemotherapy regimens, patient characteristics, and outcome definitions could explain the variations between the studies.[8]

The recovery of neutrophil counts following chemotherapy was another important finding in the present study. The mean time to ANC recovery was significantly shorter among patients receiving pegfilgrastim (11.40 ± 1.90 days) compared with those receiving filgrastim (13.00 ± 2.40 days; p=0.007). These findings were compared with Green et al. (2003), who conducted a randomized, double-blind, multicenter phase III trial involving 157 patients receiving doxorubicin and docetaxel chemotherapy. The

investigators reported that the mean duration of grade 4 neutropenia during the first chemotherapy cycle was 1.8 days in the pegfilgrastim group and 1.6 days in the filgrastim group. Febrile neutropenia occurred in 13% of pegfilgrastim recipients compared with 20% of filgrastim recipients across all chemotherapy cycles. In the present study, febrile neutropenia occurred in 7.14% and 23.81% of patients, respectively. Although Green et al. demonstrated broadly comparable neutrophil support with both agents, the present study showed significantly faster ANC recovery with pegfilgrastim. However, time to ANC recovery and duration of grade 4 neutropenia represented different outcome measures and could not be directly equated. The findings suggested that both prophylactic agents supported hematological recovery, with the present study showing a more favorable recovery profile in the pegfilgrastim group.[9] Chemotherapy treatment delays and dose modifications were important clinical consequences of chemotherapy-induced neutropenia. In the present study, neutropenia-related treatment delays occurred in 9.52% of patients receiving pegfilgrastim compared with 30.95% receiving filgrastim (p=0.028). Chemotherapy dose reductions were also significantly lower in the pegfilgrastim group (7.14% versus 26.19%; p=0.038), while the mean relative dose intensity was significantly higher (94.60 ± 6.10% versus 89.80 ± 9.10%; p=0.006). These findings were compared with Holmes et al. (2002), who conducted a multicenter dose-finding study among women with breast cancer receiving pegfilgrastim or daily filgrastim. Their study demonstrated that chemotherapy was administered on schedule in 96% of cycles supported with pegfilgrastim and 98% of cycles supported with filgrastim. Furthermore, the full planned dose of doxorubicin was delivered in 88% of cycles in both groups, while the corresponding proportion for docetaxel was 86% in both groups. The present study demonstrated greater differences in treatment delays and dose reductions between the groups, whereas the earlier clinical trial reported similarly high rates of scheduled chemotherapy delivery with both prophylactic agents. Differences in patient populations, chemotherapy protocols, administration patterns, and the measurement of treatment delays could have contributed to these variations.[10]

Febrile neutropenia was an important complication evaluated in the present study because of its association with infection, treatment interruption, and increased healthcare utilization. Febrile neutropenia developed in 3 patients (7.14%) receiving pegfilgrastim compared with 10 patients (23.81%) receiving filgrastim, although the difference was not statistically significant (p=0.067). These findings were compared with Morrison et al. (2007), who conducted a retrospective observational study involving patients receiving chemotherapy in 99 community oncology practices in the United States. During the 2003 treatment period, febrile neutropenia occurred in 67 of 1,412 patients (4.7%) receiving pegfilgrastim compared with 94 of 1,451 patients (6.5%) receiving filgrastim. After adjustment for patient and chemotherapy characteristics, filgrastim recipients had higher odds of developing febrile neutropenia than pegfilgrastim recipients (adjusted odds ratio 1.41; 95% confidence interval 1.02–1.96; p=0.040). The present study similarly demonstrated a lower observed incidence of febrile neutropenia with pegfilgrastim, although the difference was larger than that reported by Morrison et al. The lack of statistical significance in the present study could have been related to the smaller sample size and limited number of febrile neutropenia events.[11] Infectious complications, antibiotic requirements, and hospitalization represented important secondary outcomes in the present study. Clinically documented infections occurred in 9.52% of patients receiving pegfilgrastim compared with 28.57% receiving filgrastim (p=0.049). Similarly, neutropenia-related hospitalization was recorded in 4.76% and 19.05% of patients, respectively, while intravenous antibiotics were required in 7.14% and 23.81%. These findings were compared with Vogel et al. (2005), who conducted a multicenter, double-blind, placebo-controlled phase III study involving 928 patients with breast cancer receiving docetaxel chemotherapy. The investigators reported that febrile neutropenia occurred in only 1% of patients receiving pegfilgrastim compared with 17% receiving placebo (p<0.001). Febrile neutropenia-related hospitalization occurred in 1% and 14% of patients, respectively, while intravenous anti-infective therapy was required in 2% and 10% (p<0.001 for both comparisons). The present study demonstrated lower frequencies of infection-related complications among pegfilgrastim recipients, consistent with the protective effect of prophylactic pegfilgrastim reported by Vogel et al. However, the earlier study compared pegfilgrastim with placebo rather than filgrastim, and therefore its treatment effect could not be directly compared with the differences between the two active prophylactic agents in the present study.[12]

The safety profiles of pegfilgrastim and filgrastim were also evaluated in the present study. Overall G-CSF-related adverse events occurred in 40.48% of pegfilgrastim recipients and 45.24% of filgrastim recipients, without a statistically significant difference (p=0.826). Bone pain was the most frequently reported adverse event, occurring in 30.95% and 26.19% of patients, respectively, followed by myalgia (19.05% versus 23.81%) and headache (11.90% versus 14.29%). These findings were compared with Fox et al. (2009), who conducted a randomized clinical trial involving 34 children and young adults with sarcomas receiving dose-intensive chemotherapy supported with either pegfilgrastim or filgrastim. The investigators reported

that both agents were well tolerated and that growth factor-related bone pain and transient hepatic transaminase elevations occurred in fewer than 14% of chemotherapy cycles in either treatment arm. No growth factor dose modifications were required because of adverse events in either group. Although the present study reported a higher frequency of bone pain, the earlier investigation assessed a younger population receiving different chemotherapy regimens and reported some adverse events per cycle rather than per patient. Nevertheless, both studies demonstrated that pegfilgrastim and filgrastim had generally comparable safety profiles, without a statistically significant difference in the overall frequency of adverse reactions in the present study.[13]

Treatment adherence and convenience of administration constituted additional important aspects of G-CSF prophylaxis. In the present study, complete adherence to the prescribed prophylactic regimen was observed in 97.62% of patients receiving pegfilgrastim compared with 85.71% receiving filgrastim (p=0.109). The mean number of G-CSF injections required per chemotherapy cycle was 1.00 ± 0.00 in the pegfilgrastim group and 7.10 ± 1.50 in the filgrastim group. These findings were compared with Vose et al. (2003), who conducted a randomized, multicenter, open-label study involving 66 patients with relapsed or refractory lymphoma, with 33 patients allocated to each treatment group. Their investigation demonstrated that patients receiving pegfilgrastim required only one injection per chemotherapy cycle, whereas patients receiving filgrastim required a median of 11 injections per cycle. The incidence of grade 4 neutropenia was 69% in the pegfilgrastim group and 68% in the filgrastim group, while the mean duration of grade 4 neutropenia was 2.8 and 2.4 days, respectively. The present study similarly demonstrated a substantially lower injection burden with pegfilgrastim and a numerically higher adherence rate, although the adherence difference did not achieve statistical significance. The findings indicated that once-per-cycle pegfilgrastim simplified prophylactic administration, while the clinical outcomes observed in the present study suggested potential advantages that required confirmation through larger, appropriately controlled investigations.[14]

CONCLUSION

The present study suggested that pegfilgrastim was associated with a significantly lower incidence of severe chemotherapy-induced neutropenia, fewer treatment delays, and reduced chemotherapy dose modifications compared with filgrastim. Pegfilgrastim was also associated with faster neutrophil recovery, fewer clinically documented infections, and better maintenance of relative dose intensity. Both agents demonstrated comparable safety profiles, while pegfilgrastim offered greater convenience through once-per-cycle administration. These findings suggested that pegfilgrastim may be a favorable option for primary prophylaxis in patients receiving myelosuppressive chemotherapy, although larger studies are required to confirm its comparative effectiveness.

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