Reference number(s)
4758-A

STANDARD MEDICARE PART B MANAGEMENT

NEUPOGEN (filgrastim)
GRANIX (tbo-filgrastim)
NIVESTYM (filgrastim-aafi)
RELEUKO (filgrastim-ayow)
ZARXIO (filgrastim-sndz)

POLICY

I. INDICATIONS

The indications below including FDA-approved indications and compendial uses are considered a covered benefit provided that all the approval criteria are met and the member has no exclusions to the prescribed therapy.

A. FDA-Approved Indications

Neupogen

1. Patients with Cancer Receiving Myelosuppressive Chemotherapy
   Neupogen is indicated to decrease the incidence of infection, as manifested by febrile neutropenia, in patients with non-myeloid malignancies receiving myelosuppressive anti-cancer drugs associated with a significant incidence of severe neutropenia with fever.

2. Patients with Acute Myeloid Leukemia Receiving Induction or Consolidation Chemotherapy
   Neupogen is indicated for reducing the time to neutrophil recovery and the duration of fever, following induction or consolidation chemotherapy treatment of patients with acute myeloid leukemia (AML).

3. Patients with Cancer Undergoing Bone Marrow Transplantation
   Neupogen is indicated to reduce the duration of neutropenia and neutropenia-related clinical sequelae, (e.g., febrile neutropenia) in patients with non-myeloid malignancies undergoing myeloablative chemotherapy followed by marrow transplantation.

4. Patients Undergoing Autologous Peripheral Blood Progenitor Cell Collection and Therapy
   Neupogen is indicated for the mobilization of autologous hematopoietic progenitor cells into the peripheral blood for collection by leukapheresis.

5. Patients with Severe Chronic Neutropenia
   Neupogen is indicated for chronic administration to reduce the incidence and duration of sequelae of neutropenia (e.g., fever, infections, oropharyngeal ulcers) in symptomatic patients with congenital neutropenia, cyclic neutropenia, or idiopathic neutropenia.

6. Patients Acutely Exposed to Myelosuppressive Doses of Radiation (Hematopoietic Syndrome of Acute Radiation Syndrome)
   Neupogen is indicated to increase survival in patients acutely exposed to myelosuppressive doses of radiation (Hematopoietic Syndrome of Acute Radiation Syndrome).

Nivestym

1. Patients with Cancer Receiving Myelosuppressive Chemotherapy

Nivestym is indicated to decrease the incidence of infection, as manifested by febrile neutropenia, in patients with non-myeloid malignancies receiving myelosuppressive anti-cancer drugs associated with a significant incidence of severe neutropenia with fever.

2. Patients with Acute Myeloid Leukemia Receiving Induction or Consolidation Chemotherapy
   Nivestym is indicated for reducing the time to neutrophil recovery and the duration of fever, following induction or consolidation chemotherapy treatment of patients with acute myeloid leukemia (AML).

3. Patients with Cancer Undergoing Bone Marrow Transplantation (BMT)
   Nivestym is indicated to reduce the duration of neutropenia and neutropenia-related clinical sequelae, (e.g., febrile neutropenia) in patients with non-myeloid malignancies undergoing myeloablative chemotherapy followed by bone marrow transplantation.

4. Patients Undergoing Autologous Peripheral Blood Progenitor Cell Collection and Therapy
   Nivestym is indicated for the mobilization of autologous hematopoietic progenitor cells into the peripheral blood for collection by leukapheresis.

5. Patients with Severe Chronic Neutropenia
   Nivestym is indicated for chronic administration to reduce the incidence and duration of sequelae of neutropenia (e.g., fever, infections, oropharyngeal ulcers) in symptomatic patients with congenital neutropenia, cyclic neutropenia, or idiopathic neutropenia.

Granix
Granix is indicated to reduce the duration of severe neutropenia in adult and pediatric patients 1 month and older with non-myeloid malignancies receiving myelosuppressive anti-cancer drugs associated with a clinically significant incidence of febrile neutropenia.

Zarxio
1. Patients with Cancer Receiving Myelosuppressive Chemotherapy
   Zarxio is indicated to decrease the incidence of infection, as manifested by febrile neutropenia, in patients with non-myeloid malignancies receiving myelosuppressive anti-cancer drugs associated with a significant incidence of severe neutropenia with fever.

2. Patients with Acute Myeloid Leukemia Receiving Induction or Consolidation Chemotherapy
   Zarxio is indicated for reducing the time to neutrophil recovery and the duration of fever, following induction or consolidation chemotherapy treatment of adults with acute myeloid leukemia (AML).

3. Patients with Cancer Undergoing Bone Marrow Transplantation
   Zarxio is indicated to reduce the duration of neutropenia and neutropenia-related clinical sequelae, (e.g., febrile neutropenia) in patients with non-myeloid malignancies undergoing myeloablative chemotherapy followed by bone marrow transplantation.

4. Patients Undergoing Autologous Peripheral Blood Progenitor Cell Collection and Therapy
   Zarxio is indicated for the mobilization of autologous hematopoietic progenitor cells into the peripheral blood for collection by leukapheresis.

5. Patients with Severe Chronic Neutropenia
   Zarxio is indicated for chronic administration to reduce the incidence and duration of sequelae of neutropenia (e.g., fever, infections, oropharyngeal ulcers) in symptomatic patients with congenital neutropenia, cyclic neutropenia, or idiopathic neutropenia.

Releuko
1. Patients with Cancer Receiving Myelosuppressive Chemotherapy

Releuko is indicated to decrease the incidence of infection, as manifested by febrile neutropenia, in patients with non-myeloid malignancies receiving myelosuppressive anti-cancer drugs associated with a significant incidence of severe neutropenia with fever.

2. Patients with Acute Myeloid Leukemia Receiving Induction or Consolidation Chemotherapy
   Releuko is indicated for reducing the time to neutrophil recovery and the duration of fever, following induction or consolidation chemotherapy treatment of patients with acute myeloid leukemia (AML).

3. Patients with Cancer Undergoing Bone Marrow Transplantation
   Releuko is indicated to reduce the duration of neutropenia and neutropenia-related clinical sequelae, (e.g., febrile neutropenia), in patients with non-myeloid malignancies undergoing myeloablative chemotherapy followed by bone marrow transplantation.

4. Patients with Severe Chronic Neutropenia
   Releuko is indicated for chronic administration to reduce the incidence and duration of sequelae of neutropenia (e.g., fever, infections, oropharyngeal ulcers) in symptomatic patients with congenital neutropenia, cyclic neutropenia, or idiopathic neutropenia.

B. Compendial Uses
   1. Treatment of chemotherapy-induced febrile neutropenia
   2. Prophylaxis for chemotherapy-induced febrile neutropenia in patients with solid tumors
   3. Treatment of anemia and neutropenia in patients with myelodysplastic syndromes (MDS)
   4. Stem cell transplantation-related indications
   5. Agranulocytosis (non-chemotherapy drug induced)
   6. Aplastic anemia
   7. Neutropenia related to human immunodeficiency virus (HIV) infection/acquired immunodeficiency syndrome (AIDS)
   8. Neutropenia related to renal transplantation
   9. Acute myeloid leukemia
   10. Severe chronic neutropenia (congenital, cyclic, or idiopathic)
   11. Hematopoietic Subsyndrome of Acute Radiation Syndrome
   12. Supportive care for neutropenic patients with CAR T-cell-related toxicities
   13. Hairy Cell Leukemia, neutropenic fever
   14. Chronic Myeloid Leukemia, treatment of persistent neutropenia due to tyrosine kinase inhibitor therapy
   15. Glycogen Storage Disease (GSD) Type 1
   16. Reducing the instance of neonatal sepsis in infants with preeclampsia-associated neutropenia
   17. Perioperative administration of filgrastim to patients with esophageal cancer undergoing esophagectomy reduced infectious complications following surgery
   18. Improving the neutrophil count in Shwachman syndrome

All other indications will be assessed on an individual basis. Submissions for indications other than those enumerated in this policy should be accompanied by supporting evidence from Medicare approved compendia.

II. DOCUMENTATION

The following documentation must be available, upon request, for all submissions: For febrile neutropenia, submit member's diagnosis and chemotherapeutic regimen.

III. CRITERIA FOR INITIAL APPROVAL

A. Neutropenia in cancer patients receiving myelosuppressive chemotherapy
Authorization of 6 months may be granted for prevention or treatment of febrile neutropenia in cancer patients receiving myelosuppressive chemotherapy when the member will not be receiving chemotherapy and radiation therapy at the same time.

B. Other indications
Authorization of 6 months may be granted for members with any of the following indications:

1. Myelodysplastic syndrome (anemia or neutropenia)
2. Stem cell transplantation-related indications
3. Agranulocytosis (non-chemotherapy drug induced)
4. Aplastic anemia
5. Neutropenia related to HIV/AIDS
6. Neutropenia related to renal transplantation
7. Acute myeloid leukemia
8. Severe chronic neutropenia (congenital, cyclic, or idiopathic)
9. Hematopoietic Subsyndrome of Acute Radiation Syndrome
   Treatment for radiation-induced myelosuppression following a radiological/nuclear incident
10. CAR T-cell-related toxicities
    Supportive care for neutropenic patients with CAR T-cell-related toxicities
11. Hairy Cell Leukemia
    Members with hairy cell leukemia with neutropenic fever following chemotherapy
12. Chronic Myeloid Leukemia
    Members with chronic myeloid leukemia (CML) for treatment of persistent neutropenia due to tyrosine kinase inhibitor therapy
13. Glycogen Storage Disease (GSD) Type 1
    Individuals with GSD Type 1 for treatment of low neutrophil counts
14. Reducing the instance of neonatal sepsis in infants with preeclampsia-associated neutropenia
15. Perioperative administration of filgrastim to patients with esophageal cancer undergoing esophagectomy to reduce infectious complications following surgery
16. Improving the neutrophil count in Shwachman syndrome

IV. CONTINUATION OF THERAPY

All members (including new members) requesting authorization for continuation of therapy must be currently receiving therapy with the requested agent.

A. Authorization for 6 months may be granted for the treatment of chronic myeloid leukemia when all of the following criteria are met:
   1. The member is currently receiving therapy with the requested medication.
   2. The member is receiving benefit from therapy. Benefit is defined as:
      i. No evidence of unacceptable toxicity while on the current regimen
      ii. No evidence of disease progression while on the current regimen

B. For all other diagnoses, all members (including new members) requesting authorization for continuation of therapy must meet all initial authorization criteria.

V. SUMMARY OF EVIDENCE

The contents of this policy were created after examining the following resources:

1. The prescribing information for Neupogen, Granix, Nivestym, Releuko, and Zarxio.
2. The available compendium
    a. National Comprehensive Cancer Network (NCCN) Drugs and Biologics Compendium
    b. Micromedex DrugDex
    c. American Hospital Formulary Service- Drug Information (AHFS-DI)
    d. Lexi-Drugs
    e. Clinical Pharmacology
3. NCCN Guideline: Myelodysplastic syndromes
4. NCCN Guideline: Hematopoietic growth factors
5. NCCN Guideline: Hematopoietic cell transplantation
6. NCCN Guideline: Management of immunotherapy-related toxicities
7. NCCN Guideline: Acute myeloid leukemia
8. NCCN Guideline: Hairy cell leukemia
9. NCCN Guideline: Chronic myeloid leukemia
10. Diagnosis and management of glycogen storage disease type I: a practice guideline of the American College of Medical Genetics and Genomics
11. 2010 Update of EORTC guidelines for the use of granulocyte-colony stimulating factor to reduce the incidence of chemotherapy-induced febrile neutropenia in adult patients with lymphoproliferative disorders and solid tumors.
12. Recommendations for the use of white blood cell growth factors: American Society of Clinical Oncology Practice Guideline Update
13. 2006 update of recommendations for the use of white blood cell growth factors: an evidence-based clinical practice guideline
14. 1999 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus

After reviewing the information in the above resources, the FDA-approved indications listed in the prescribing information for Neupogen, Granix, Nivestym, Releuko, and Zarxio are covered in addition to the following:

1. Treatment of chemotherapy-induced febrile neutropenia
2. Prophylaxis for chemotherapy- induced febrile neutropenia in patients with solid tumors
3. Treatment of anemia and neutropenia in patients with myelodysplastic syndromes (MDS)
4. Stem cell transplantation-related indications
5. Agranulocytosis (non-chemotherapy drug induced)
6. Aplastic anemia
7. Neutropenia related to human immunodeficiency virus (HIV) infection/acquired immunodeficiency syndrome (AIDS)
8. Neutropenia related to renal transplantation
9. Acute myeloid leukemia
10. Supporting care for neutropenic patients with CAR T-cell-related toxicities
11. Hairy cell leukemia, neutropenic fever
12. Chronic myeloid leukemia, treatment of persistent neutropenia due to tyrosine kinase inhibitor therapy
13. Glycogen storage disease type I
14. Reducing the instance of neonatal sepsis in infants with preeclampsia-associated neutropenia
15. Perioperative administration of filgrastim to patients with esophageal cancer undergoing esophagectomy reduced infectious complications following surgery
16. Improving neutrophil count in Shwachman syndrome

VI. EXPLANATION OF RATIONALE

Support for FDA-approved indications can be found in the manufacturer's prescribing information.

Support for using filgrastim to treat anemia and neutropenia in patients with myelodysplastic syndromes can be found in the National Comprehensive Cancer Network's guideline for myelodysplastic syndromes. The NCCN Guideline for myelodysplastic syndromes supports the use of filgrastim as treatment of lower risk (IPSS-R very low, low, intermediate) disease associated with symptomatic anemia with no del(5q), with or without other cytogenetic abnormalities with ring sideroblasts greater than or equal to 15% (or ring sideroblasts greater than or equal to 5% with an SF3B1 mutation), with serum erythropoietin less than or equal to 500 mU/mL in combination with an erythropoiesis-stimulating agent (ESA). The guideline also supports using filgrastim to treat lower risk disease as previously described following no response (despite adequate iron stores) or erythroid response followed by loss of response to an ESA alone.

Support for using filgrastim as prophylaxis against febrile neutropenia in patients receiving chemotherapy for solid tumors and non-myeloid malignancies can be found in the National Comprehensive Cancer Network's guideline for hematopoietic growth factors. The NCCN Guideline for hematopoietic growth factors supports the use of filgrastim as prophylaxis of chemotherapy-induced febrile neutropenia or other dose limiting neutropenic events in high-risk (greater than 20% overall risk of febrile neutropenia) in patients with solid tumors and non-myeloid malignancies receiving treatment in the curative/adjuvant or palliative settings.
The guideline also supports using filgrastim for prophylaxis of chemotherapy-induced febrile neutropenia or other dose-limiting neutropenic events in intermediate-risk (10% to 20% overall risk of febrile neutropenia) patients with solid tumors and non-myeloid malignancies receiving treatment in the curative/adjuvant or palliative settings who have one or more patient risk factors. Consider using filgrastim for prophylaxis of chemotherapy-induced febrile neutropenia or other dose-limiting neutropenic events in low-risk (<10% overall risk of febrile neutropenia) patients with solid tumors and non-myeloid malignancies receiving treatment in the curative/adjuvant or palliative settings who have 2 or more patient-related risk factors. Use of granulocyte colony-stimulating factors in this setting is based on clinical judgment.

Support for using filgrastim as treatment of chemotherapy-induced febrile neutropenia can be found in the National Comprehensive Cancer Network's guideline for hematopoietic growth factors. The NCCN Guideline for hematopoietic growth factors supports the use of filgrastim in patients who have been receiving prophylactic filgrastim. Consider in patients who have not received prophylactic granulocyte colony-stimulating factors but who have risk factors for an infection-associated complication.

Support for using filgrastim in hematopoietic stem cell transplantation can be found in the National Comprehensive Cancer Network's guideline for hematopoietic stem cell transplantation. The NCCN Guideline supports the use of filgrastim as treatment for hematopoietic cell mobilization for autologous donors in combination with any of the following: plerixafor, in combination with cyclophosphamide with or without plerixafor, as a single agent, or in combination with disease-specific chemotherapy with or without plerixafor. Filgrastim can also be used as treatment for hematopoietic cell mobilization for allogenic donors as a single agent. Finally, filgrastim can be used as additional therapy for insufficient collection of stem cells in combination with plerixafor following treatment with filgrastim alone or filgrastim and disease-specific chemotherapy.

Support for using filgrastim in the management of CAR T-cell-related toxicities can be found in the National Comprehensive Cancer Network's guideline for Management of Immunotherapy-related toxicities. Filgrastim can be considered as supportive care for neutropenic patients.

Support for using filgrastim in patients with acute myeloid leukemia can be found in the National Comprehensive Cancer Network's guideline for acute myeloid leukemia. The NCCN Guideline supports the use of filgrastim for treatment induction in patients who are candidates for intensive induction therapy with favorable-risk AML (CBF-AML, NPM1-mutated/FLT3 wild-type AML, in-frame bZIP mutation in CEBPA) in combination with fludarabine, high-dose cytarabine, and idarubicin plus gemtuzumab ozogamicin. Filgrastim can also be used for treatment induction in patients as part of an alternative non-anthracycline-containing regimen (eg, FLAG) who are candidates for intensive induction therapy who exceed anthracycline dose or have cardiac issues but are still able to receive aggressive therapy. It is appropriate to use filgrastim as a

component of repeating the initial successful induction regimen if late relapse (≥12 months since induction regimen). Filgrastim can be used for relapsed/refractory disease in combination with cladribine and cytarabine, with or without mitoxantrone or idarubicin. Finally, filgrastim can be used for relapsed/refractory disease in combination with fludarabine and cytarabine, with or without idarubicin.

Support for using filgrastim in hairy cell leukemia can be found in the National Comprehensive Cancer Network's guideline for hairy cell leukemia. The NCCN Guideline indicates that neutrophil growth factors, such as filgrastim, are indicated for patients with neutropenic fever following systemic therapy.

Support for using filgrastim in chronic myeloid leukemia can be found in the National Comprehensive Cancer Network's guideline for chronic myeloid leukemia. The NCCN Guideline for chronic myeloid leukemia supports the use of granulocyte colony stimulating factors to overcome imatinib-induced neutropenia in patients with persistent neutropenia.

Support for using filgrastim to treat aplastic anemia is supported by two studies. In a series of 17 Japanese adults with severe aplastic anemia, an immunosuppressive regimen with concomitant granulocyte colony-stimulating factor (G-CSF) induced a good response in 82%. Dosing consisted of intravenous (IV) methylprednisolone 20 milligrams/kilogram/day (mg/kg/day) on days 1 to 3 with decreasing doses of 10 mg/kg/day to 2.5 mg/kg/day for days 4 to 6, anti-lymphocyte globulin or anti-thymocyte globulin 30 mg/kg/day for 5 days, oral cyclosporine 5 mg/kg/day initially then adjusted to maintain trough levels at 200 to 250 nanograms/milliliter, and subcutaneous G-CSF 250 micrograms/day. Good response was defined as meeting at least two of the following criteria: absolute reticulocyte, neutrophil, and platelet counts above 60,000/microliter, 1000/microliter and 50,000/microliter, respectively, or hemoglobin increase of greater than 2 grams/deciliter without transfusion. The median time to reach this endpoint in responders was 3 months. Three of 17 individuals died, including two non-responders and one responder who later developed paroxysmal nocturnal hemoglobinuria (PNH). Three other instances of PNH and one case of myelodysplastic syndrome ensued. Of 14 survivors (5.7 to 63.1 months of follow-up), only three did not require maintenance immunosuppression with or without G-CSF, or bone marrow transplant (Matsuo et al).
In a randomized trial of 69 children with moderate to severe acquired aplastic anemia, the addition of granulocyte colony-stimulating factor (G-CSF) to a multi-drug immunosuppressive regimen did not improve efficacy. 50 subjects classified as having very severe aplastic anemia (VSAA) (platelet, reticulocyte and neutrophil counts less than 20,000/microliter (mcL), 20,000/mcL and 200/mcL, respectively) were uniformly treated with a G-CSF-containing regimen. The overall trilineage response rates in the very severe aplastic anemia (VSAA), G-CSF +, and G-CSF - groups were not statistically significant at 3 months (47%, 39%, and 53%), 6 months (71%, 55%, and 77%), and 12 months (73%, 60%, and 73%), respectively. The 3 groups did not differ significantly with respect to survival, infectious complications, relapse rates, new cytogenetic abnormalities, or clonal disease evolution. Subjects received intravenous (IV) horse anti-thymocyte globulin (Lymphoglobuline(R)) 1.5 vials/10 kilograms (kg)/day infused over 12 hours for 5 days, methylprednisolone 2 milligrams (mg)/kg/day IV on days 1 to 7, then 1 mg/kg/day orally on days 8 to 14 and tapered to end on day 30, oral cyclosporine 6 mg/kg/day adjusted to maintain whole blood trough levels of 100 to 200 nanograms/milliliter on days 1 to 180, oral danazol 5 mg/kg/day on days 1 to 180, with (G-CSF +; n=35) or without (G-CSF -; n=34) IV or subcutaneous G-CSF 400 micrograms/square meter days 1-90. G-CSF administration was changed to thrice weekly once the absolute neutrophil count reached 5x10(9) per liter. Drug treatment was well tolerated with drug-related toxicity similar among the G-CSF + and G-CSF - groups. The authors recommend against initial adjunctive G-CSF except in VSAA (Kojima et al).

Support for using filgrastim to treat neutropenia related to renal transplantation can be found in a case report by Derici et al. Neutropenia in a renal transplant patient was successfully treated with granulocyte colony-stimulating factor (G-CSF) (filgrastim; Neupogen(R)). One year after transplantation, a 32-year-old patient with end-stage renal disease was diagnosed with chronic rejection by biopsy and admitted to the hospital; chest X-ray revealed infiltration in the middle left lung. Fluconazole, azathioprine, and filgrastim 6 micrograms/kilogram/day subcutaneously were started. After G-CSF administration, fever resolved and the

white cell count rose from 500/cubic millimeter to 22,7000/cubic millimeter; azathioprine was restarted. No rejection episodes or adverse effects were noted.

Support for using filgrastim for glycogen storage disease type I can be found in a guideline published by the American College of Medical Genetics and Genomics. Neutropenia and recurrent infections are a common manifestation of glycogen storage disease type 1. Administration of granulocyte colony stimulating factors like filgrastim increases blood neutrophil counts to normal or above normal levels. Neutropenic patients with GSD Ib should be treated with G-CSF, particularly if there is already a history and pattern of fever, infections, or enterocolitis. The lowest effective G-CSF dose should be used to avoid worsening of splenomegaly, hypersplenism, hepatomegaly, and bone pain. G-CSF should be administered subcutaneously starting at 0.5–1.0 µg per kilogram per day given daily or every other day. The G-CSF dose should be increased stepwise at approximately 2-week intervals until the target ANC of more than 500 to up to 1.0×109 /l is reached. This dose then should be maintained, adjusting for subsequent increases in the patient's weight with growth and development. Blood count with manual differential should be monitored several times per year. Bone marrow examinations are not recommended unless there is an unexpected change in the patient's other blood counts.

Support for using filgrastim to reduce neonatal sepsis in infants with preeclampsia-associated neutropenia can be found in a study by Kocherlakota et al. Filgrastim was found to be beneficial in increasing the absolute neutrophil count (ANC) and reducing the incidence of neonatal sepsis in infants with preeclampsia-associated neutropenia. In an unblinded study, patients (n=28) were assigned to conventional treatment or treatment with filgrastim (5 or 10 micrograms/kilogram (mcg/kg)/day). The ANC had doubled in 24 hours in the 10 mcg/kg group and no change was seen in the 5 mcg/kg group or conventional treatment group. In the filgrastim group, 13% were diagnosed with sepsis, whereas 54% in the conventional treatment group were.

Support for using filgrastim to reduce infectious complications following esophagectomy can be found in a small study by Schafer et al. When compared to patients in a historical control group (n=77), filgrastim administration to patients with esophageal cancer undergoing esophagectomy (n=20) resulted in a significant reduction in the infection rate during the 10 days following surgery. Patients in the study group were given filgrastim 300 micrograms/day (mcg/day) subcutaneously to 480 mcg/day depending on body weight starting 2 days before surgery and discontinued on day 7 following surgery. Ten days following surgery, no complications had occurred in the study group; however, 29.9% of patients (n=23) in the control developed infections (p=0.008). For postoperative days 11 and up, the significant difference in infection between the two groups was not maintained.

Support for using filgrastim to improve neutrophil count in Shwachman syndrome can be found in a case report by Adachi et al. Filgrastim has successfully treated a 1.5-year-old male with Shwachman syndrome. Improvement in the neutrophil count (from 552/microliter (mcL) to 45,300/mcL) occurred following 7 days of filgrastim therapy (100 micrograms/square meter).

Support for using filgrastim to treat neutropenia caused by HIV can be found in guidelines issued by the U.S. Public Health Service (USPHS). Administration of granulocyte-macrophage (GM-CSF) may be considered for patients with human immunodeficiency virus (HIV) infection to reverse neutropenia. This use, however, would not be routinely indicated. The recommended dosage is 5 to 10 micrograms/square meter/day given subcutaneously for 2 to 4 weeks.

VII. REFERENCES

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