

LEUKEMIA CHEMOTHERAPY REGIMENS Part 1 of 2

The selection, dosing, and administration of anti-cancer agents and the management of associated toxicities are complex. Drug dose modifications and schedule and initiation of supportive care interventions are often necessary because of expected toxicities and because of individual patient variability, prior treatment, and comorbidities. Thus, the optimal delivery of anti-cancer agents requires a healthcare delivery team experienced in the use of such agents and the management of associated toxicities in patients with cancer. The chemotherapy regimens below may include both FDA-approved and unapproved uses/regimens and are provided as references only to the latest treatment strategies. Clinicians must choose and verify treatment options based on the individual patient.

REGIMEN	DOSING
ACUTE MYELOID LEUKEMIA (AML)	
INDUCTION THERAPY	
Cytarabine (Cytosar-U; ARA-C) + an anthracycline (daunorubicin [Cerubidine], idarubicin [Idamycin], mitoxantrone [Novantrone])	<p>Days 1–3: An anthracycline (eg, daunorubicin at least 60mg/m²/day IV, idarubicin 10–12mg/m²/day IV, or mitoxantrone 10–12mg/m²/day IV), plus</p> <p>Days 1–7: Cytarabine 100–200mg/m²/day continuous IV infusion.¹ or</p> <hr style="border-top: 1px dashed black;"/> <p>Days 1–3: An anthracycline (eg, daunorubicin 45mg/m²/day IV, idarubicin 12mg/m²/day IV, or mitoxantrone 12mg/m²/day IV), plus</p> <p>Days 1–7: Cytarabine 100mg/m²/day continuous IV infusion.²</p>
Intermediate-dose cytarabine ³	<p><u>Cycle 1</u></p> <p>Days 1–7: Cytarabine 200mg/m²/day continuous IV infusion, plus</p> <p>Days 5–6: Idarubicin 12mg/m²/day IV.</p> <p><u>Cycle 2</u></p> <p>Days 1–6: Cytarabine 1,000 mg/m² continuous IV infusion for 3hrs twice daily, plus</p> <p>Days 3, 5, 7: Amsacrine 120mg/m²/day</p>
CONSOLIDATION THERAPY	
Cytarabine + idarubicin ⁴	<p>Days 1: Idarubicin 9mg/m² IV, plus</p> <p>Days 1–5: Cytarabine 60mg/m² SQ every 12hrs.</p> <p>Repeat cycle monthly for 6 cycles.</p>
Cytarabine + daunorubicin ⁴	<p>Days 1: Daunorubicin 45mg/m² IV, plus</p> <p>Days 1–5: Cytarabine 60mg/m² SQ every 12hrs.</p> <p>Repeat cycle monthly for 6 cycles.</p>
RELAPSED/REFRACTORY AML	
ADE (cytarabine + daunorubicin + etoposide [Toposar, VePesid, Etopophos; VP-16]) ⁵	<p><u>Course 1</u></p> <p>Days 1–10: Cytarabine 100mg/m² IV every 12hrs, plus</p> <p>Days 1, 3, 5: Daunorubicin 50mg/m²/day IV, plus</p> <p>Days 1–5: Etoposide 100mg/m²/day IV.</p> <p><u>Course 2</u></p> <p>Days 1–8: Cytarabine 100mg/m² IV every 12hrs, plus</p> <p>Days 1, 3, 5: Daunorubicin 50mg/m²/day IV, plus</p> <p>Days 1–5: Etoposide 100mg/m²/day IV.</p>
CLAG-M (cladribine [Leustatin] + cytarabine + mitoxantrone) ⁶	<p><u>Induction therapy</u></p> <p>Days 1–5: Cladribine 5mg/m²/day IV followed by cytarabine 2g/m²/day IV, plus</p> <p>Days 1–3: Mitoxantrone 10mg/m²/day IV.</p> <p>Repeat cycle if partial response. Proceed with consolidation chemotherapy once complete response is achieved.</p> <p><u>Consolidation therapy - Course 1</u></p> <p>Days 1–3: Cytarabine 1.5g/m²/day IV, plus</p> <p>Days 3–5: Mitoxantrone 10mg/m²/day IV.</p> <p><u>Consolidation therapy - Course 2</u></p> <p>Days 1, 3, 5: Cytarabine 2g/m² IV every 12hrs ± cladribine 5mg/m²/day</p>
Azacitidine (Vidaza) ⁷	<p>Days 1–7: Azacitidine 75mg/m²/day SQ.</p> <p>Repeat cycle every 28 days for at least 4 cycles.</p>

(continued)

REGIMEN	DOSING
ACUTE MYELOID LEUKEMIA (AML) (continued)	
RELAPSED/REFRACTORY AML (continued)	
Tipifarnib (Zarnestra) ⁸	Days 1–21: Tipifarnib 600mg orally twice a day. Repeat cycle every 28 days. After 3 cycles, may increase dose to tipifarnib 900mg orally twice daily if no significant drug-related toxicity.
Lenalidomide (Revlimid) ⁹	<u>Cycle 1</u> Days 1–14: Lenalidomide 50mg/day orally once daily; followed by 30 days off therapy. <u>Cycle 2</u> Days 1–21: Lenalidomide 35mg/day orally once daily; followed by 30 days off therapy. No therapy Cycle 3. <u>Subsequent cycles</u> Days 1–28: Lenalidomide 5mg/day orally once daily for 5 cycles.
CHRONIC MYELOGENOUS LEUKEMIA (CML)	
Imatinib (Gleevec)	Imatinib 400mg orally once daily. ^{10,11} May increase to imatinib 600–800mg orally once daily if complete response not achieved within 3 months. ¹²
Dasatinib (Sprycel)	Dasatinib 140mg orally once daily or 70mg orally twice daily. ^{13,14} or ----- Dasatinib 100mg orally twice daily. ¹⁵
Nilotinib (Tasigna) ^{16,17,18}	<u>Newly diagnosed Philadelphia chromosome-positive chronic phase myeloid leukemia (Ph+ CML-CP)</u> Nilotinib 300mg orally twice daily. <u>Resistant or intolerant Ph+ CML-CP and acute phase CML</u> Nilotinib 400mg orally twice daily.

REFERENCES

1. Döhner H, Estey EH, Amadori S, et al. European LeukemiaNet. Diagnosis and management of acute myeloid leukemia in adults: recommendations from an international expert panel, on behalf of the European LeukemiaNet. *Blood*. 2010;115:453–474.

2. Rowe JM, Neuberg D, Friedenberg W, et al. Eastern Cooperative Oncology. A phase 3 study of three induction regimens and of priming with GM-CSF in older adults with acute myeloid leukemia: a trial by the Eastern Cooperative Oncology Group. *Blood*. 2004;103:479–485.

3. Löwenberg B, Pabst T, Vellenga E, et al. Dutch-Belgian Cooperative Trial Group for Hemato-Oncology (HOVON) and Swiss Group for Clinical Cancer Research (SAKK) Collaborative Group. Cytarabine dose for acute myeloid leukemia. *N Engl J Med*. 2011;364:1027–1036.

4. Gardin C, Turlure P, Fagot T, et al. for the Acute Leukemia French Association (ALFA). Postremission treatment of elderly patients with acute myeloid leukemia in first complete remission after intensive induction chemotherapy: results of the multicenter randomized Acute Leukemia French Association (ALFA) 9803 trial. *Blood*. 2007;109:5129–5135.

5. Milligan DW, Wheatley K, Littlewood T, Craig JJO, Burnett AK, for the NCRI Haematological Oncology Clinical Studies Group. Fludarabine and cytosine are less effective than standard ADE chemotherapy in high-risk acute myeloid leukemia, and addition of G-CSF and ATRA are not beneficial: results of the MRC AML-HR randomized trial. *Blood*. 2006;107:4614–4622.

6. Wierzbowska A, Robak T, Pluta A, et al. Cladribine combined with high doses of arabinoside cytosine, mitoxantrone, and G-CSF (CLAG-M) is a highly effective salvage regimen in patients with refractory and relapsed acute myeloid leukemia of the poor risk: a final report of the Polish Adult Leukemia Group. *Eur J Haematol*. 2008;80:115–126.

7. Thepot S, Itzykson R, Seegers V, et al. Groupe Francophone des Myelodysplasies (GFM). Treatment of progression of Philadelphia-negative myeloproliferative neoplasms to myelodysplastic syndrome or acute myeloid leukemia by azacitidine: a report on 54 cases on the behalf of the Groupe Francophone des Myelodysplasies (GFM). *Blood*. 2010;116:3735–3742.

8. Harsousseau JL, Lancet JE, Reiffers J, et al. A phase 2 study of the oral farnesyltransferase inhibitor tipifarnib in patients with refractory or relapsed acute myeloid leukemia. *Blood*. 2007;109:5151–5156.

9. Fehniger TA, Byrd JC, Marcucci G, et al. Single-agent lenalidomide induces complete remission of acute myeloid leukemia in patients with isolated trisomy 13. *Blood*. 2009;113:1002–1005.

10. de Lavallade H, Apperley JF, Khorashad JS, et al. Imatinib for newly diagnosed patients with chronic myeloid leukemia: incidence of sustained responses in an intention-to-treat analysis. *J Clin Oncol*. 2008;26:3358–3363.

11. Gleevec [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corp., 2011.

12. Hochhaus A, Druker B, Sawyers C, et al. Favorable long-term follow-up results over 6 years for response, survival, and safety with imatinib mesylate therapy in chronic-phase chronic myeloid leukemia after failure of interferon- α treatment. *Blood*. 2008;111:1039–1043.

13. Kantarjian H, Pasquini R, Hamerschlak N, et al. Dasatinib or high-dose imatinib for chronic-phase chronic myeloid leukemia after failure of first-line imatinib: a randomized phase 2 trial. *Blood*. 2007;109:5143–5150.

14. Saglio G, Hochhaus A, Goh YT, et al. Dasatinib in imatinib-resistant or imatinib-intolerant chronic myeloid leukemia in blast phase after 2 years of follow-up in a phase 3 study: efficacy and tolerability of 140 milligrams once daily and 70 milligrams twice daily. *Cancer*. 2010;116:3852–3861.

15. Cortes J, Rousselot P, Kim DW, et al. Dasatinib induces complete hematologic and cytogenetic responses in patients with imatinib-resistant or -intolerant chronic myeloid leukemia in blast crisis. *Blood*. 2007;109:3207–3213.

16. Saglio G, Kim DW, Issaragrisil S, le Coutre P, Etienne G, Lobo C, Pasquini R, Clark RE, Hochhaus A, Hughes TP, Gallagher N, Hoenekopp A, Dong M, Haque A, Larson RA, Kantarjian HM; ENESTnd Investigators. Nilotinib versus imatinib for newly diagnosed chronic myeloid leukemia. *N Engl J Med*. 2010;362:2251–2259.

17. Le Coutre PL, Ottmann OG, Giles F, et al. Nilotinib (formerly AMN107), a highly selective BCR-ABL tyrosine kinase inhibitor, is active in patients with imatinib-resistant or -intolerant accelerated-phase chronic myelogenous leukemia. *Blood*. 2008;111:1834–1839.

18. Tasigna [prescribing information]. East Hanover, NJ: Novartis Pharmaceuticals Corp., 2011.