

## Midostaurin and Intermediate Dose Cytarabine Consolidation Therapy<sup>i</sup>

### INDICATIONS FOR USE:

INDICATION	ICD10	Regimen Code	HSE approved reimbursement status*
Midostaurin is indicated in combination with intermediate dose cytarabine consolidation chemotherapy for adult patients with newly diagnosed acute myeloid leukaemia (AML) who are FLT3 mutation positive.	C92	00683a	Midostaurin: CDS 01/10/2021 Cytarabine: N/A

\*This is for post 2012 indications only

### TREATMENT:

*The starting dose of the drugs detailed below may be adjusted downward by the prescribing clinician, using their independent medical judgement, to consider each patients individual clinical circumstances.*

- Patients who achieve complete remission after one cycle of induction therapy with Midostaurin and DAUNOrubicin and Cytarabine Induction Therapy (Ref NCCP Regimen 00682) may at the discretion of the prescribing Consultant either:
  - Receive a second cycle of induction treatment (Ref NCCP Regimen 00682).
 and
  - **Two** cycles of consolidation therapy (described below) at the discretion of the prescribing consultant.

**OR**

- Receive **three** cycles of consolidation therapy (described below) at the discretion of the prescribing Consultant.

**Patients should generally receive a total of 4 cycles of treatment between the induction and consolidation cycles (e.g. 2+2 or 1+3).**

- Consolidation treatment is administered as detailed in the treatment table.
- Each consolidation cycle is four weeks in duration, and should begin within two weeks following haematologic recovery (ANC  $\geq 1 \times 10^9/L$ , platelet count  $\geq 100 \times 10^9/L$ ), but not sooner than four weeks from the beginning of the previous cycle.

Facilities to treat anaphylaxis MUST be present when systemic anti-cancer therapy (SACT) is administered.

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Admin. Order	Day	Drug	Dose	Route	Diluent & Rate	Cycle
1	1, 3 and 5	Cytarabine	1500mg/m <sup>2</sup> <b>AM</b>	IV infusion	500ml NaCl 0.9% over 4 hours	Every 28 days for 2 to 3 cycles ( see above)
2	1, 3 and 5	Cytarabine	1500mg/m <sup>2</sup> <b>PM</b> (12 hours after start of <b>AM</b> infusion)	IV infusion	500ml NaCl 0.9% over 4 hours	Every 28 days for 2 to 3 cycles (see above)
3	8 to 21 inclusive	Midostaurin	50mg twice daily	PO	n/a	Every 28 days for 2 to 3 cycles(see above)

Patients aged  $\geq 61$  years should receive cytarabine 1000 mg/m<sup>2</sup> TWICE a day.

Midostaurin capsules should be taken with food at approximately 12 hour intervals. The capsules should be swallowed whole with a glass of water. They should not be opened, crushed or chewed to ensure proper dosing and avoid the unpleasant taste of the capsule content.

If a dose is missed, the patient should take the next dose at the scheduled time. If vomiting occurs, the patient should not take an additional dose of midostaurin, but should take the next scheduled dose.

## ELIGIBILITY:

- Indication as above
- AML diagnosis with FLT3 mutation confirmed using a validated test excluding FLT 3 positive acute promyelocytic leukaemia

## EXCLUSIONS:

- Hypersensitivity to cytarabine, midostaurin or any of the excipients
- Concomitant administration of potent CYP3A4 Inducers
- Symptomatic congestive heart failure
- Bilirubin  $> 2.5$  x upper limit of normal
- Pregnancy / Lactation

## PRESCRIPTIVE AUTHORITY:

The treatment plan must be initiated by a Consultant Haematologist working in the area of haematological malignancies.

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## TESTS:

### Baseline tests:

- FBC, renal and liver profiles, magnesium level
- Chest x-ray
- TFT, ECG (QTc interval)
- MUGA or ECHO
- Virus serology: cytomegalovirus(CMV) infection, HIV (human immunodeficiency virus), hepatitis B (HBsAg, HBcoreAb),C.  
\*Hepatitis B reactivation: See Adverse effects/ Regimen specific complications
- $\beta$ hCG pregnancy test

### Regular tests:

- FBC, renal and liver profiles
- Coagulation profile: APTT, PT, fibrinogen level
- ECG (QTc interval) Day 8 (prior to commencing midostaurin) and as clinically indicated thereafter
- LVEF when clinically indicated

### Disease monitoring:

Disease monitoring should be in line with the patient's treatment plan and any other test/s as directed by the supervising Consultant.

## DOSE MODIFICATIONS:

- Any dose modification should be discussed with a Consultant.
- **Elderly ( $\geq 65$  years):** No dose adjustment of midostaurin is required in patients aged over 65 years. In patients aged  $\geq 60$  years, midostaurin should be used only in patients eligible to receive intensive induction chemotherapy with adequate performance status and without significant comorbidities.

## Renal and Hepatic Impairment:

**Table 1: Dose modification in renal and hepatic impairment**

Drug	Renal Impairment		Hepatic Impairment
	CrCl (mls/min)	Dose	
Cytarabine	>60	100%	Mild and moderate: no need for dose adjustment is expected Severe: consider 25-50% of the original dose and increase if tolerated
	31-59	50%	
	<30	Not recommended	

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	Haemodialysis	50% of the original dose, start haemodialysis 4-5 h after administration	
<b>Midostaurin</b>	CrCl ≥ 30ml/min: no dose adjustment is needed CrCl < 30ml/min: no need for dose adjustment is expected Haemodialysis: no need for dose adjustment is expected		Mild / moderate (Child-Pugh A and B): no dose adjustment Severe or Child Pugh C: not recommended

**Management of adverse events:**

**Table 2: Dose Modification of midostaurin for Adverse Events**

Criteria	Midostaurin dosing
Grade 3/4 pulmonary infiltrates	Interrupt midostaurin for the remainder of the cycle. Resume midostaurin at the same dose when infiltrate resolves to Grade ≤1.
Other Grade 3/4 non-haematological toxicities	Interrupt midostaurin until toxicities considered at least possibly related to midostaurin have resolved to Grade ≤2, then resume midostaurin.
QTc interval >470 msec and ≤500 msec	Decrease midostaurin to 50 mg once daily for the remainder of the cycle. Resume midostaurin at the initial dose in the next cycle provided that QTc interval improves to ≤470 msec at the start of that cycle. Otherwise continue midostaurin 50 mg once daily.
QTc interval >500 msec	Withhold or interrupt midostaurin for the remainder of the cycle. If QTc improves to ≤470 msec just prior to the next cycle, resume midostaurin at the initial dose. If QTc interval is not improved in time to start the next cycle do not administer midostaurin during that cycle. Midostaurin may be held for as many cycles as necessary until QTc improves.

**SUPPORTIVE CARE:**

**EMETOGENIC POTENTIAL:**

**Cytarabine:** Moderate (**Refer to local policy**)

**Midostaurin:** Moderate to High (**Refer to local policy**)

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## PREMEDICATIONS:

### Cytarabine:

To prevent a chemical induced conjunctivitis developing with cytarabine, prednisolONE eye drops (e.g. Pred Mild®) 1-2 drops per eye 4 hourly during waking hours prior to cytarabine and continued 5 days post treatment should be administered.

## OTHER SUPPORTIVE CARE:

- Tumour lysis syndrome prophylaxis (**Refer to local policy**)
- Proton pump Inhibitor (**Refer to local policy**)
- Anti-viral prophylaxis (**Refer to local policy**)
- Anti-fungal prophylaxis (**Refer to local policy**). Strong CYP3A4 inhibitors (e.g. posaconazole) can increase midostaurin exposure. If concomitant use is required, an ECG should be performed prior to commencement of the CYP3A4 inhibitor to assess the QTc and QTc should continue to be monitored by regular ECGs. In addition, monitoring of posaconazole levels is recommended.

## ADVERSE EFFECTS / REGIMEN SPECIFIC COMPLICATIONS:

*The adverse effects listed are not exhaustive. Please refer to the relevant Summary of Product Characteristics for full details.*

### Midostaurin:

- **Neutropenia and infections:** Neutropenia has occurred in patients receiving midostaurin as monotherapy and in combination with chemotherapy. White blood cell counts (WBCs) should be monitored regularly, especially at treatment initiation. In patients who develop unexplained severe neutropenia beyond what is usually expected in AML, treatment with midostaurin should be interrupted until ANC is  $\geq 1.0 \times 10^9/L$ . Midostaurin should be discontinued in patients who develop recurrent or prolonged severe neutropenia that is suspected to be related to midostaurin. Any active serious infection should be under control prior to starting treatment with midostaurin monotherapy.
- **Cardiac dysfunction:** Patients with symptomatic congestive heart failure were excluded from clinical studies. In patients at risk, midostaurin should be used with caution and the patient closely monitored by assessing LVEF when clinically indicated (at baseline and during treatment). An increased frequency of QTc prolongation was noted in midostaurin-treated patients, however, a mechanistic explanation for this observation was not found. Caution is warranted in patients at risk of QTc prolongation (e.g. due to concomitant medicinal products and/or electrolyte disturbances). Interval assessments of QT by ECG should be considered if midostaurin is taken concurrently with medicinal products that can prolong QT interval.

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- **Pulmonary toxicity:** Interstitial lung disease (ILD) and pneumonitis, in some cases fatal, have occurred in patients treated with midostaurin monotherapy or in combination with chemotherapy. Patients should be monitored for pulmonary symptoms indicative of ILD or pneumonitis and midostaurin discontinued in patients who experience pulmonary symptoms indicative of ILD or pneumonitis that are  $\geq$  Grade 3 (NCI CTCAE).
- **Embryofetal toxicity:** Pregnant women should be informed of the potential risk to a foetus; females of reproductive potential should be advised to have a pregnancy test within 7 days prior to starting treatment with midostaurin and to use effective contraception during treatment with midostaurin and for at least 4 months after stopping treatment. Women using hormonal contraceptives should add a barrier method of contraception.
- **Breast-feeding:** Breast-feeding should be discontinued during treatment with midostaurin and for at least four months after stopping treatment.
- **Hepatitis B Reactivation:** Patients should be tested for both HBsAg and HBcoreAb as per local policy. If either test is positive, such patients should be treated with anti-viral therapy (**Refer to local infectious disease policy**). These patients should be considered for assessment by hepatology.

### Cytarabine:

- **Cytarabine syndrome:** Treatment with cytarabine may cause a 'Cytarabine Syndrome' characterised by flu-like symptoms, skin rash and occasionally chest pain.
- **Myelosuppression:** Cytarabine is a potent bone marrow suppressant. Patients receiving this drug must be under close medical supervision and should have leucocyte and platelet counts performed daily.
- **Neurotoxicity:** This may occur in patients treated with high dose cytarabine. Assess cerebellar function prior to each cytarabine dose. The risk of neurotoxicity is enhanced in the presence of renal impairment. Ensure that dose of cytarabine is adjusted in renal impairment.

### DRUG INTERACTIONS:

- Medicinal products or substances known to affect the activity of CYP3A4 may affect the plasma concentrations of midostaurin and therefore the safety and/or efficacy of midostaurin.
  - Concomitant use of midostaurin with strong inducers of CYP3A4 (e.g. carbamazepine, rifampicin, enzalutamide, phenytoin, St. John's Wort [*Hypericum perforatum*]) is contraindicated - strong CYP3A4 inducers decrease exposure of midostaurin and its active metabolites.
  - Strong CYP3A4 inhibitors such as azole antifungals may increase midostaurin blood concentrations.
- Midostaurin is a mild inducer of CYP2B6. Medicinal products with a narrow therapeutic range that are substrates of CYP2B6 (e.g. bupropion or efavirenz) should be used with caution when administered concomitantly with midostaurin, and may need dose adjustment to maintain optimal exposure.

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- Midostaurin is a mild inhibitor of BCRP substrates. Medicinal products with a narrow therapeutic range that are substrates of the transporter BCRP (e.g. rosuvastatin or atorvastatin) should be used with caution when administered concomitantly with midostaurin, and may need dose adjustment to maintain optimal exposure.
- Current drug interaction databases should be consulted for more information.

## REFERENCES:

1. Stone RM et al. Midostaurin plus Chemotherapy for Acute Myeloid Leukemia with a FLT3 Mutation. N Engl J Med. 2017 Aug 3;377(5):454-464. doi: 10.1056/NEJMoa1614359. Epub 2017 Jun 23. PMID: 28644114; PMCID: PMC5754190.
2. Krens S D, Lassche, Jansman G F G A, et al. Dose recommendations for anticancer drugs in patients with renal or hepatic impairment. Lancet Onco/2019; 20:e201-08. [https://doi.org/10.1016/S1470-2045\(19\)30145-7](https://doi.org/10.1016/S1470-2045(19)30145-7)
3. NCCP Classification Document for Systemic Anti-Cancer Therapy (SACT) Induced Nausea and Vomiting. V5 2023. Available at: <https://www.hse.ie/eng/services/list/5/cancer/profinfo/chemoprotocols/nccp-classification-document-for-systemic-anti-cancer-therapy-sact-induced-nausea-and-vomiting.pdf>
4. Cytarabine Solution for Injection Summary of Product Characteristics. Last updated 18/08/2021. Accessed July 2023. Available at: [https://www.hpra.ie/img/uploaded/swedocuments/Licence\\_PA0822-200-002\\_18082021114137.pdf](https://www.hpra.ie/img/uploaded/swedocuments/Licence_PA0822-200-002_18082021114137.pdf)
5. Midostaurin (Rydapt®) Summary of Product Characteristics. Last updated 11/05/2023. Accessed July 2023. Available at: [https://www.ema.europa.eu/en/documents/product-information/rydapt-epar-product-information\\_en.pdf](https://www.ema.europa.eu/en/documents/product-information/rydapt-epar-product-information_en.pdf)

Version	Date	Amendment	Approved By
1	28/01/2022		NCCP Myeloid Clinical Advisory Group
2	08/12/2023	Reviewed. Amended treatment table (footnotes). Updated exclusions and dose modifications (re: elderly patients). Updated dose modification in renal/hepatic impairment. Updated adverse effects and drug interactions.	Dr. Eibhlin Conneally

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<sup>i</sup> 'This regimen is outside its licensed indication in Ireland. Patients should be informed of the unlicensed nature of this indication and consented to treatment in line with the hospital's policy on the use of unlicensed medication and unlicensed or "off label" indications. Prescribers should be aware of their responsibility in communicating any relevant information to the patient and also in ensuring that the unlicensed or "off label" indication has been acknowledged by the hospital's Drugs and Therapeutics Committee, or equivalent, in line with hospital policy.'

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