

Midostaurin for treating advanced systemic mastocytosis

Technology appraisal guidance

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Your responsibility

The recommendations in this guidance represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, health professionals are expected to take this guidance fully into account, alongside the individual needs, preferences and values of their patients. The application of the recommendations in this guidance is at the discretion of health professionals and their individual patients and do not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or their carer or guardian.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the [Yellow Card Scheme](#).

Commissioners and/or providers have a responsibility to provide the funding required to enable the guidance to be applied when individual health professionals and their patients wish to use it, in accordance with the NHS Constitution. They should do so in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should [assess and reduce the environmental impact of implementing NICE recommendations](#) wherever possible.

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1 Recommendations

- 1.1 Midostaurin monotherapy is recommended, within its marketing authorisation, as an option for treating aggressive systemic mastocytosis, systemic mastocytosis with associated haematological neoplasm, or mast cell leukaemia in adults. It is recommended only if the company provides midostaurin according to the [commercial arrangement](#).

Why the committee made these recommendations

There is no standard treatment for advanced systemic mastocytosis (aggressive systemic mastocytosis, systemic mastocytosis with associated haematological neoplasm, or mast cell leukaemia). Current treatments include interferon alpha, pegylated interferon alpha, cladribine, imatinib, and treatments usually used for acute myeloid leukaemia. Midostaurin aims to treat the disease and its symptoms.

Evidence suggests that midostaurin is more effective than current treatments, but this is uncertain because it was not compared directly with these. Also, better quality comparative evidence is unlikely to become available.

Midostaurin meets NICE's criteria for a life-extending treatment at the end of life, which means that higher cost-effectiveness estimates can be considered. This means that, despite the uncertainty about the clinical evidence, the cost-effectiveness estimates are within the range that NICE considers acceptable. So, midostaurin is recommended.

2 Information about midostaurin

Marketing authorisation indication

- 2.1 Midostaurin (Rydapt, Novartis) is indicated 'as monotherapy for the treatment of adult patients with aggressive systemic mastocytosis (ASM), systemic mastocytosis with associated haematological neoplasm (SM-AHN), or mast cell leukaemia (MCL)'.

Dosage in the marketing authorisation

- 2.2 The dosage schedule is available in the [summary of product characteristics](#).

Price

- 2.3 The list price of midostaurin is £5,609.94 for a 56-pack of 25 mg capsules (excluding VAT; BNF online, accessed September 2020), which equates to an annual cost of £292,719 at the standard dose of 100 mg twice daily.
- 2.4 The company has a [commercial arrangement](#). This makes midostaurin available to the NHS with a discount. The size of the discount is commercial in confidence. It is the company's responsibility to let relevant NHS organisations know details of the discount.

3 Committee discussion

The [appraisal committee](#) considered evidence submitted by Novartis, a review of this submission by the evidence review group (ERG), NICE's technical report, and responses from stakeholders. See the [committee papers](#) for full details of the evidence.

The appraisal committee was aware that several issues were resolved during the technical engagement stage, and agreed that:

- The 2 single-arm midostaurin clinical trials, D2201 and A2213, are sufficiently generalisable to NHS practice in England for decision making.
- The 3 subtypes of advanced systemic mastocytosis (aggressive systemic mastocytosis [ASM], systemic mastocytosis with associated haematological neoplasm [SM-AHN], and mast cell leukaemia [MCL]) are usually clinically distinct.
- It is appropriate to pool the D2201 and A2213 studies to inform the comparative effectiveness estimate used in decision making.

It recognised that there were remaining areas of uncertainty associated with the analyses presented (see technical report, key issues summary, page 2), and took these into account in its decision making. It discussed the following issues in further detail which were outstanding after the technical engagement stage.

Treatment pathway and comparator

There is an unmet need for a disease-modifying treatment for advanced systemic mastocytosis

- 3.1 Mastocytosis is a rare group of heterogenous diseases characterised by excessive mast cells. It includes advanced systemic mastocytosis, which is a severe form of the disease with 3 diverse subtypes. ASM is typically the least severe subtype, followed by SM-AHN, then MCL which has a life expectancy of less than 1 year. The clinical experts advised that the treatment pathway for advanced systemic mastocytosis is complex. Treatment is individualised based on symptoms, and because of the

diversity of the disease subtypes. There are no licensed, targeted or disease-modifying therapies to treat advanced systemic mastocytosis currently available in the NHS. The patient and clinical experts advised that the condition has a poor prognosis with current treatment options, particularly for SM-AHN or MCL. The patient experts also explained that the symptoms of advanced systemic mastocytosis have a major debilitating effect on their daily activities and quality of life. These include frequent and unexpected anaphylaxis, diarrhoea and vomiting. Available treatments do little to improve these symptoms and may cause additional side effects. The committee concluded that there is an unmet need for people with advanced systemic mastocytosis, and that people with the condition would welcome a disease-modifying treatment option like midostaurin.

A mixture of treatments used in current clinical practice is the most appropriate comparator

3.2 The company's evidence submission compared midostaurin with how advanced systemic mastocytosis is currently treated in clinical practice (current clinical management). It used a composite comparator (a representative mixture of treatments currently used) including interferon alpha, cladribine, imatinib, pegylated interferon alpha and treatments that are typically used to treat acute myeloid leukaemia, such as azacitidine. The proportion of the composite comparator made up by each treatment was informed by opinions from 5 clinical experts. The committee recalled that there are no treatments licensed for advanced systemic mastocytosis in current NHS practice, and that treatment is highly individualised (see [section 3.1](#)). The clinical experts confirmed that the company's composite comparator is a reasonable representation of the treatments used in current NHS practice. The committee recognised that it would be difficult to identify a single treatment option to use as the comparator. It concluded that current clinical management, as defined by the company, was the appropriate comparator for decision making.

Clinical effectiveness evidence

The clinical effectiveness evidence for midostaurin is from 2 single-arm non-randomised trials

- 3.3 The clinical evidence for midostaurin came from D2201 and A2213, 2 non-randomised, open-label, single-arm clinical trials. Both trials included people with the 3 subtypes of advanced systemic mastocytosis (see [section 3.1](#)). D2201 was an international trial, including 4 patients from the UK, and A2213 was a US study. The median overall survival (OS) for advanced systemic mastocytosis from D2201 (December 2014 data, n=89) was 26.8 months. The median OS was shortest for MCL (9.4 months), followed by SM-AHN (20.7 months), then ASM (51.1 months). The results of a more recent data cut were similar (August 2017; results are confidential and cannot be reported here). Median OS in the overall population in A2213 (n=26) was 40 months. The committee noted that more than half of the people in D2201 had stopped treatment with midostaurin within 1 year, with 19% of patients still having treatment at 3 years. The committee concluded that because D2201 and A2213 are single-arm trials, they do not provide evidence of the relative effectiveness of midostaurin compared with current treatment options. But it acknowledged that doing a phase 3 trial for advanced systemic mastocytosis would be difficult.

Comparative effectiveness evidence

The comparative evidence for midostaurin is uncertain, but estimates from Reiter et al. (2017) are suitable for decision making

- 3.4 The company's evidence submission did not include any studies that directly compared midostaurin with treatments currently used in NHS practice. The main comparative effectiveness evidence was from 2 non-randomised studies, Reiter et al. (2017) and CEREMAST. Reiter et al. pooled midostaurin time-to-event data from the D2201 and A2213 trials and compared it with outcomes from German registry data for treatment without midostaurin. The CEREMAST study compared outcomes from a

midostaurin compassionate use programme in France with outcomes from French registry data for treatment without midostaurin. The company's preferred analyses used results from Reiter et al. The committee noted that the study was presented at a conference, but was otherwise unpublished, meaning it had received less scrutiny than if it had been fully peer reviewed. The company explained that it was not aware of planned publications by the study investigators, but that it had identified very little comparative effectiveness evidence because advanced systemic mastocytosis is rare. It had determined Reiter et al. to be the best evidence available. The clinical expert explained that the registry used in Reiter et al. remains the main source of data used internationally. The ERG agreed with the company's conclusion that Reiter et al. was the best available source of comparative effectiveness evidence. But it highlighted its limitations, which included its small sample size, and limited information about what treatments were used and study recruitment. It also noted the risk of bias present in all non-randomised evidence. The ERG also advised that there are potential limitations to pooling data from the D2201 and A2213 trials, because they have different study protocols and median follow-up durations. In response to technical engagement, a clinical expert advised that the A2213 study is likely to be less generalisable to NHS clinical practice than D2201. The committee agreed that there is limited evidence for midostaurin because the condition is rare, so data from the 2 studies could be pooled for decision making. It agreed that Reiter et al. was more robust than the CEREMAST study. The committee noted ongoing data collection by the European Competence Network on Mastocytosis registry and considered whether it might provide more robust evidence on outcomes with current treatments. A patient expert advised that, although the registry has data for approximately 500 people with advanced systemic mastocytosis, some of them might already be having treatment with midostaurin, and the frequency of follow up is unclear. The committee concluded that the quality of comparative effectiveness evidence was poor, but in the absence of more robust evidence it would consider outcomes from Reiter et al. in its decision making. It agreed that it would interpret the resulting estimates (see [section 3.5](#)) with caution.

The propensity score matched hazard ratio suggests midostaurin is more effective than current clinical management, but this is

uncertain

3.5 The comparative OS of midostaurin was by far the most important clinical factor affecting its cost effectiveness. In its evidence submission, the company considered several OS hazard ratios (HRs), based on Reiter et al. (2017), as options to inform the comparative effectiveness of midostaurin. After technical engagement, the company updated some of the HR analyses using a more recent D2201 data cut (containing 1 extra year of data). The committee noted that the company's preferred HR was from a multivariable regression analysis using pooled D2201 and A2213 data for midostaurin (0.52, 95% confidence interval [CI] 0.32 to 0.84). This analysis attempted to account for potential imbalances in patient characteristics between the midostaurin clinical trials and the German registry data from Reiter et al. The committee was concerned that the company's preferred HR was similar to the HR that did not adjust for imbalances (0.50, 95% CI 0.33 to 0.76). This suggested that the regression analysis might not have fully captured important observed or unobserved differences between the datasets. The committee considered that the propensity score matching analysis might provide a more unbiased estimate of the HR (0.64, 95% CI 0.33 to 1.24). The ERG advised that the propensity score matching analysis meant reducing the sample size (to achieve 2 groups of 'matched' pairs of patients), and it may be preferable to retain the bigger sample size used by the multivariable regression analysis. It also advised that, like the regression analysis, the matching analysis cannot adjust for any unobserved imbalances in patient characteristics. The committee noted that in the propensity score matched analysis the number of patients was substantially lower, which led to a wider CI but suggested that the unadjusted patient groups were not well matched. It considered that, on balance, it would prefer an unbiased estimate of the HR with a wider CI, rather than a potentially biased estimate of the HR with a narrower CI. The committee concluded that, from the available HRs to inform comparative survival, the propensity score matched HR was the most robust estimate to inform the economic model and decision making. The committee also concluded that, based on its preferred HR, midostaurin does appear to be clinically effective compared with current clinical management, but the estimate remains uncertain.

Economic model

The company's economic model is broadly acceptable for decision making

3.6 The company presented a partitioned survival model with 4 mutually exclusive health states: 2 progression-free survival (PFS) states (with either sustained response, or lack or loss of response), progressed disease and death. The model used a lifetime time horizon. People entered the model in 1 of the 2 PFS states depending on the disease's initial response to treatment. They could move from PFS (sustained response) to PFS (lack or loss of response), informed by duration of response data. The company fitted parametric curves to D2201 time-to-event data to estimate transition probabilities, and applied HRs from Reiter et al. (see [section 3.5](#)) to estimate outcomes for current clinical management. The ERG advised that the parametric curves for midostaurin had been selected appropriately and appeared to be reasonable. The committee concluded that the company's economic model was broadly acceptable for decision making.

The model should use 1 health state with a single utility value for progression-free survival

3.7 The company's model partitioned PFS by response status (see [section 3.6](#)), to allow the utility value for progression-free disease to differ depending on response to treatment. The company stated that this was supported by clinical advice stating that quality of life is affected by treatment response. The ERG recognised that PFS may be different for people whose disease responded and those whose disease did not, based on the trial data. However, it had concerns about the reliability of the response rate and duration data used by the company to partition the progression-free health state. It considered that the data was not appropriate for this purpose. The ERG also advised that it is inconsistent to partition PFS by response status without similarly partitioning OS, because the trial data also suggested that OS was affected by treatment response. In response to technical engagement, the company provided a revised analysis using a single utility value for the progression-free

health state. The committee recognised the limitations of the data for partitioning PFS and the inconsistency in not partitioning OS. It agreed that partitioning OS would increase the model's reliance on uncertain response data. Therefore, the committee concluded that the model should have 1 PFS health state, with a single utility value from the company's revised analysis.

The utility estimates might not capture the full effect of midostaurin on quality of life

3.8 The committee noted that the utility values used in the model had been derived from the single-arm D2201 trial, so it had not seen quality-of-life evidence from people having current clinical management. It recalled that advanced systemic mastocytosis often has a major debilitating effect on a person's life (see [section 3.1](#)). The patient experts advised that the quality-of-life improvement after starting treatment with midostaurin was rapid and substantial. One patient expert explained that they had beneficial effects after 1 week of starting treatment, and up to 10 hours of normal life per day after 1 month of treatment. The clinical experts also reiterated the large improvement in quality of life with midostaurin. They advised that there is very little comparator quality-of-life data available because midostaurin is increasingly being used before other treatments in other countries. The committee considered that, although it had not seen quality-of-life evidence directly related to current clinical management, it is likely that the utility estimates used in the model did not capture all of the benefits of midostaurin that had been described by the patient and clinical experts. It recalled its earlier conclusion that the response data was too uncertain to implement response-based utility values (see [section 3.7](#)), which might have been a way to include the quality-of-life benefits of midostaurin. The committee concluded that the incremental quality-adjusted life years (QALYs) estimated by the model may be conservative for midostaurin, and that it would consider this in its decision making.

A 3-year treatment benefit is suitable for decision making, although this might be optimistic

3.9 The company's base-case model applied the comparative effectiveness

HR for the duration of the model (38 years), which assumed that the benefit of starting treatment with midostaurin lasts for a person's lifetime. The ERG considered that a lifetime treatment benefit was unlikely to be plausible, and that the progression and survival rates with midostaurin would instead become equal to other treatments over time. In response to technical engagement, the company presented alternative analyses in which the HR became 1 (no treatment effect) after 3, 5 and 10 years. The clinical experts advised that the longer a person has midostaurin, the more sustained disease response is. But they noted that disease response can be lost because of associated haematological malignancy instead of mastocytosis itself. They also advised that while there is no known resistance to midostaurin, its effect dissipates rapidly after stopping treatment, even if doses are only missed for a few days. The committee considered whether it was appropriate to include a lifetime treatment benefit in the model. It recalled that most people did not continue to have midostaurin in the long term (see [section 3.3](#)). The committee considered that it was implausible to retain the Reiter et al. (2017) HR for people who were no longer having midostaurin. It also noted that it had not seen long-term, robust comparative effectiveness evidence, so the duration of treatment benefit is uncertain. The committee considered that a 3-year midostaurin benefit duration is likely to be optimistic for people who stop having treatment before 3 years. But it considered it potentially pessimistic for the minority of people who remain on treatment beyond 3 years, to an unknown extent. On balance, the committee concluded that it would consider a 3-year treatment benefit duration for midostaurin in its decision making, even though this was likely to be optimistic.

End of life

Midostaurin is considered to be a life-extending treatment at the end of life

- 3.10 The committee considered the advice about life-extending treatments for people with a short life expectancy in [NICE's guide to the methods of technology appraisal](#). The committee considered whether midostaurin meets both end of life criteria for people with advanced systemic

mastocytosis. For the life expectancy criterion, the committee noted that Reiter et al. (2017), which it had accepted as a source of comparative effectiveness evidence (see [section 3.4](#)), reported a median survival with current clinical management of 19.5 months. The committee agreed that life expectancy was clearly lower than 24 months for people with MCL, but that this is less clear for advanced systemic mastocytosis overall. Some sources of evidence reported median survival estimates above 24 months, but the company explained that these studies often included people with indolent systemic mastocytosis, which is much less severe and has a longer life expectancy than advanced systematic mastocytosis. For the life extension criterion, the committee noted that Reiter et al. reported a median survival benefit of 21.9 months for midostaurin compared with current clinical management. It also noted that the economic model predicted a mean survival benefit far higher than the 3 months stipulated by the life extension criterion. The patient and clinical experts advised that there is increasing clinical experience and evidence, albeit non-randomised, suggesting that midostaurin improves life expectancy considerably. Therefore, the committee concluded that midostaurin could be considered a life-extending treatment at the end of life.

Cost-effectiveness estimates

Cost-effectiveness estimates are below £50,000 per QALY gained so midostaurin is recommended

3.11 The committee noted that midostaurin could be considered a life-extending treatment at the end of life (see [section 3.10](#)), so an acceptable incremental cost-effectiveness ratio (ICER) would be below £50,000 per QALY gained. The committee recalled its preferred assumptions for decision making:

- Using the Reiter et al. (2017) propensity score matched OS HR (see [section 3.4](#) and [section 3.5](#)).
- Using a single PFS health state, with a single utility value from the company's revised analysis (see [section 3.7](#)).

- Assuming that the treatment benefit of midostaurin lasts for 3 years, after which its progression and survival rates become equal to the comparator (see [section 3.9](#)).

With the preferred assumptions, and taking all relevant commercial arrangements into consideration, the cost-effectiveness estimates for the overall population and the subgroup with more severe disease (SM-AHN or MCL) were below £50,000 per QALY gained. The committee considered that the estimates were uncertain because of limitations in the clinical and comparative effectiveness evidence (see [section 3.4](#), [section 3.5](#) and [section 3.9](#)). It also recalled its conclusion that the incremental QALY estimates from the model might not capture all the quality-of-life benefits associated with midostaurin compared with current treatment options (see [section 3.8](#)). Despite the limitations in the evidence, the cost-effectiveness estimates were within what NICE considers acceptable. So, the committee concluded that midostaurin could be recommended.

Innovation

Midostaurin is an innovative treatment for advanced systemic mastocytosis

3.12 The company considered midostaurin to be innovative because there are currently no other licensed or targeted disease-modifying treatment options for people with advanced systemic mastocytosis. The patient and clinical experts emphasised the importance of alleviating debilitating symptoms and improving health-related quality of life, and the potential benefit from midostaurin in achieving this (see [section 3.1](#)). The committee recalled that the utility values used in the economic model might not capture all quality-of-life benefits associated with midostaurin, because there were no quality-of-life data from people having current clinical management (see [section 3.8](#)). However, it had taken this potential uncertainty into account in its decision making (see [section 3.11](#)). The committee concluded that midostaurin is innovative.

Equality

There are no equality issues relevant to the recommendation

- 3.13 No equality issues were raised during scoping and technical engagement. No potential equality issues were identified in the company submission. The committee concluded that there were no equality issues relevant to the recommendation.

4 Implementation

- 4.1 Section 7 of the National Institute for Health and Care Excellence (Constitution and Functions) and the Health and Social Care Information Centre (Functions) Regulations 2013 requires clinical commissioning groups, NHS England and, with respect to their public health functions, local authorities to comply with the recommendations in this appraisal within 3 months of its date of publication.
- 4.2 Chapter 2 of Appraisal and funding of cancer drugs from July 2016 (including the new Cancer Drugs Fund) – A new deal for patients, taxpayers and industry states that for those drugs with a draft recommendation for routine commissioning, interim funding will be available (from the overall Cancer Drugs Fund budget) from the point of marketing authorisation, or from release of positive draft guidance, whichever is later. Interim funding will end 90 days after positive final guidance is published (or 30 days in the case of drugs with an Early Access to Medicines Scheme designation or fast track appraisal), at which point funding will switch to routine commissioning budgets. The NHS England and NHS Improvement Cancer Drugs Fund list provides up-to-date information on all cancer treatments recommended by NICE since 2016. This includes whether they have received a marketing authorisation and been launched in the UK.
- 4.3 The Welsh ministers have issued directions to the NHS in Wales on implementing NICE technology appraisal guidance. When a NICE technology appraisal recommends the use of a drug or treatment, or other technology, the NHS in Wales must usually provide funding and resources for it within 2 months of the first publication of the final appraisal document.
- 4.4 When NICE recommends a treatment 'as an option', the NHS must make sure it is available within the period set out in the paragraphs above. This means that, if a patient has aggressive systemic mastocytosis, systemic mastocytosis with associated haematological neoplasm or mast cell leukaemia (advanced systemic mastocytosis) and the doctor responsible for their care thinks that midostaurin is the right treatment, it should be

available for use, in line with NICE's recommendations.

5 Appraisal committee members and NICE project team

Appraisal committee members

The 4 technology appraisal committees are standing advisory committees of NICE. This topic was considered by [committee C](#).

Committee members are asked to declare any interests in the technology to be appraised. If it is considered there is a conflict of interest, the member is excluded from participating further in that appraisal.

The [minutes of each appraisal committee meeting](#), which include the names of the members who attended and their declarations of interests, are posted on the NICE website.

NICE project team

Each technology appraisal is assigned to a team consisting of 1 or more health technology analysts (who act as technical leads for the appraisal), a technical adviser and a project manager.

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