NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Centre for Health Technology Evaluation

MTG Review Decision

Review of MTG8: MiraQ for assessing graft flow during coronary artery bypass graft surgery

This guidance was issued in November 2011 and previously reviewed and amended in February 2018.

NICE proposes an amendment of published guidance if there are no changes to the technology, clinical environment or evidence base which are likely to result in a change to the recommendations. However the recommendations may need revision to correct any inaccuracies or to update to current formats. The decision to consult on an amendment of published guidance depends on the impact of the proposed amendments and on NICE's perception of their likely acceptance with stakeholders. NICE proposes an update of published guidance if the evidence base or clinical environment has changed to an extent that is likely to have a material effect on the recommendations in the existing guidance.

1. Recommendation

Amend the guidance to reflect the updated costs around using MiraQ. These factual changes proposed have no material effect on the recommendations.

Update the format of the recommendations and insert a section below section 1 titled 'Why the committee made these recommendations', in line with the current template wording and presentation.

Please see Appendix 1 for a list of the options and their explanations for consideration.

2. Original objective of guidance

To assess the case for adoption of MiraQ for assessing graft flow during coronary artery bypass graft surgery.

3. Current guidance

1.1. The case for adopting the MiraQ system in the NHS for assessing graft flow during coronary artery bypass graft (CABG) surgery is supported by the

evidence. The evidence suggests that intraoperative transit time flow measurement is effective in detecting imperfections that may be corrected by graft revision. This may reduce the incidence of graft occlusion and may reduce perioperative morbidity and mortality.

1.2. *The MiraQ system is associated with an estimated cost saving of £141 per patient compared with clinical assessment, when it is used routinely for assessing coronary artery bypass grafts during surgery [2018 – see section 5.12].*

4. Rationale

The original guidance recommended the VeriQ system for assessing graft flow during coronary artery bypass graft (CABG) surgery. During the 2018 guidance review, the guidance was updated to make recommendations on the use of an equivalent replacement technology, MiraQ. The cost model was also updated due to changes in the price of the device. The new clinical evidence was also reviewed but no changes were made to the guidance in response to the new evidence. For the 2022 review, the costs were updated again due to changes in the cost of the technology. This led to a reduction in cost savings from £141 to £80.27. Although 87 studies were reviewed by the EAC, none of the evidence justified amending the clinical evidence or clinical parameters of the economic model. Overall, the guidance needs amending to reflect the updated costs of the MiraQ system.

5. New evidence

The search strategy from the original assessment report was re-run. References from November 2011 onwards (that had not already been summarised by NICE in the 2018 guidance review) were reviewed. Additional searches of clinical trials registries were also carried out and relevant guidance from NICE and other professional bodies was reviewed to determine whether there had been any changes to the care pathways. The company was asked to submit all new literature references relevant to their technology, along with updated costs and details of any changes to the technology itself or the CE marked indication for use for their technology. The results of the literature search are discussed in the 'Summary of evidence and implications for review' section below. See Appendix 2 for further details of ongoing and unpublished studies.

5.1 Technology availability and changes

The company (Medistim) stated that there have been no changes to the technology design considered in the guidance and that the technology is still available in the UK. They stated that the costs of the MiraQ device and probes have increased.

5.2 Clinical practice

NICE's guideline on acute coronary syndromes (NG185) and NICE's clinical guideline on stable angina: management (CG126) suggests considering the use of coronary revascularisation (including coronary artery bypass graft surgery; CABG) for people with stable angina whose symptoms are not satisfactorily controlled with optimal medical treatment, or where appropriate after an myocardial infarction. These guidelines do not mention transit time flow measurement (TTFM) devices or graft assessment.

ESC/EACTS guidelines on myocardial revascularisation (2018) state that TTFM is the most frequently used technique for graft assessment and has been able to detect 2% to 4% of grafts that require revision. In observational studies, the use of intraoperative graft assessment has been shown to reduce the rate of adverse events and graft failure, although interpretation can be challenging in sequential and T-graft configurations.

Two clinical experts responded to NICE's request for information. One expert uses the technology routinely for CABG surgeries. They had charitable funding for the purchase of a VeriQ system. The other expert would be interested in using the device, but it is not available to them. This is because of budget constraints leading to difficulties in funding less essential equipment. Neither expert was aware of any competing technologies. Both experts stated that infrastructure is needed for the sterilisation (autoclaving) of the reusable flow probes, which may require sending the probes to another hospital. Both experts said that training is needed to produce accurate results and interpret the flowmetry information. One expert noted the ongoing cost of the flow probes, which need to be replaced after 50 sterilisation cycles. They stated that the reliability of measurements appears to fall in older probes nearing end of use. Another expert said that there is no evidence that the probe remains accurate after 29 probe sterilisations. One expert thought that the original economic model assumptions were controversial as it did not consider the waste of probes that are not used within expiry dates and their valid sterilisation timeframes. Both experts said that there are ongoing discussions on the use of MiraQ flow measurement against intra-operative transoesophageal echocardiogram and ECG data, and whether placing too much clinical weight on a MiraQ measurement may lead to unnecessary graft revision.

In response to these comments, the company stated that they guarantee each probe will remain accurate for 50 uses and that the probes do not have an expiry date. The probe instructions for use state that the probes are validated for the specified number of sterilisation cycles and warranted against manufacturing defects for one year from the date of first use.

5.3 NICE facilitated research

None.

5.4 New studies

The updated literature searches identified 87 studies that were deemed in scope by the EAC. These included:

- 9 randomised controlled trials (RCTs, in which the Medistim device [MiraQ or previous equivalent versions] was used in both arms rather than as the intervention or comparator)
- 2 subgroups of people from an RCT
- 76 cohort studies (including 1 with a control group, and 6 with propensity matching).

Two studies were available as pre-prints only (Urbanowicz et al. 2021; Zhao et al. 2020b). A comparative conference abstract was also included as it reported in-hospital CABG outcomes with and without the Medistim device (Laali et al. 2021).

Studies ranged in size between 12 (Martinovic et al. 2019) and 4,406 (Vrancic et al. 2019) people (one study did not report sample size; Girish Gowda et al. 2019). Three studies were done in a UK NHS setting (Amin et al. 2019, Amin et al. 2018a, Amin et al. 2018b).

Four studies reported on measurement accuracy of the Medistim device relative to an intraoperative comparator (quantitative free flow, laser doppler flowmetry and coronary angiography with indocyanine green; Amin et al. 2018b, Girish Gowda et al. 2019, Hellmann et al. 2020, Yamamoto et al. 2017). Three studies used the Medistim device as the standard care comparator (Dreifaldt et al. 2013, Erdem et al. 2015, Joshi et al. 2020). Most studies also included other imaging techniques alongside the Medistim device but did not undertake any comparison of results.

The EAC overall concluded that the majority of evidence identified was single arm with large heterogeneity between studies. This meant there was insufficient high-quality evidence to justify an update to the guidance. Full details of the clinical studies can be found in the EAC's clinical evidence review report.

5.5 Cost update

The cost parameters were updated in the economic model to include changes in device, maintenance, and probe prices. The cost of acquiring a MiraQ device has increased from £34,000 to £35,955, and the annual maintenance cost (assuming 10-year life span) has decreased from £1,800 to £1,369.80. The cost of a TTFM PS probe has increased from £1,481 to £1,720. The EAC also updated staff costs using PSSRU Unit Costs of Health & Social Care 2019/20 information, and procedure costs from NHS Reference costs 2019/20. The EAC inflated costs to 2020 prices (using the most up to date version of the Consumer Price Index data available at the time of the costing model update) where the cost source was not readily available. Experts stated that there were no substantial changes to the clinical pathway.

The updated cost model showed a cost saving for MiraQ of £80.27 when compared to clinical assessment. This is a decrease from the previous cost saving of £141.

The EAC conducted sensitivity analysis which shows MiraQ to be cost saving when compared against clinical assessment. The only scenarios which result in the technology being cost incurring are those which consider the rate of intra-aortic balloon pump (IABP) insertion and myocardial infarction (MI) to be equivalent across MiraQ and clinical assessment arms, which the EAC considered to be unlikely. The EAC's threshold analysis showed that MiraQ only becomes cost incurring if the lifespan of the probe drops to 21 uses, or if the difference in rate of MI (between MiraQ and clinical assessment) was 0.9% or lower, or if the difference in rate of IABP insertion (between MiraQ and clinical assessment) was 1.3% or lower. One clinical expert felt that these thresholds were clinically unlikely. Another expert thought that the lifespan of the probe being less than 21 uses was unlikely but was uncertain about whether MiraQ use would lead to an absolute difference in MI and IABP of 0.9% and 1.3%, respectively, as MI and IABP rates were low in their NHS trust.

The EAC identified and corrected two errors in the summary table of sensitivity analyses for mean number of probes used in procedure and MI rates. These reduced the size of the cost savings in both analyses but did not change the direction of the results.

The full costing update can be found in the EAC's cost update report. The EAC reviewed all the clinical evidence and concluded there was no justification to amend the clinical parameters of the economic model, as the majority of evidence identified was single arm and was heterogeneous. This is summarised in full in the EAC's clinical evidence review.

6. Summary of new information and implications for review

The new clinical evidence is unlikely to have a material effect on the recommendations in the published guidance as the new evidence reports results from mixed populations and procedure characteristics. Only one study compared TTFM (using a Medistim device) with no TTFM in CABG patients, but it was only available as a conference abstract, lacked a detailed description of methodology, with limited reporting of in-hospital outcomes. It is likely that the lack of new comparative evidence is because MiraQ or TTFM is considered as standard care.

This new published evidence was also not robust enough to amend the clinical parameters in the economic model. This is because there was no new evidence found for some parameters used in the model:

- Number of probes used
- Probe uses

- Duration of minor revision
- Duration of major revision (weighted mean of on-pump and off-pump)

There was no new comparative evidence for some parameters:

- Re-exploration of bleeding
- Deep sternal infection
- IABP insertion
- Peri- or postoperative myocardial infarction
- Hospital days to discharge
- Mean minor revision rate
- Mean major revision rate

The new comparative evidence was limited to that reported by one conference abstract (Laali et al. 2021):

- Duration of TTFM, per procedure
- Overall post-operative morbidity
- Overall post-operative mortality
- Major cardiac adverse events (MACE)
- Mortality
- Mortality, excluding emergency patients

For the rate of patients with revisions, the EAC found 38 studies that reported the need for graft revision, 11 of which reported intra-operative revision occurring in between 0% and 11.6% of patients. As the sensitivity analysis of the updated economic model used an intra-operative revision rate of 6.58% to 14.60%, which is greater than that reported in the evidence, the EAC did not update this parameter in the economic modelling.

Updating the costs in the economic model led to a reduction in overall cost savings for MiraQ from £141 to £80.27 when compared to clinical assessment. Overall, there is no evidence to suggest a change to the committee's clinical conclusions from the original guidance.

7. Implementation

The company's updated information states that around 13 NHS England hospitals use MiraQ. One expert said that they are not able to use the device due to budget constraints, which may explain the low uptake of the technology.

8. Equality issues

NICE is committed to promoting equality of opportunity, eliminating unlawful discrimination and fostering good relations between people with particular protected characteristics and others.

No equality issues were raised in the original guidance. No new equality issues were identified during guidance review.

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Appendix 1 – explanation of options

If the published Medical Technologies Guidance needs updating NICE must select one of the options in the table below:

Options	**Consequences**	**Selected – 'Yes/No'**
Amend the guidance and consult on the review proposal	The guidance is amended but the factual changes proposed have no material effect on the recommendations.	No
Amend the guidance and do not consult on the review proposal	The guidance is amended but the factual changes proposed have no material effect on the recommendations.	Yes
Standard update of the guidance	A standard update of the Medical Technologies Guidance will be planned into NICE's work programme.	No
Update of the guidance within another piece of NICE guidance	The guidance is updated according to the processes and timetable of that programme.	No

If the published Medical Technologies Guidance does not need updating NICE must select one of the options in the table below:

Options	**Consequences**	**Selected – 'Yes/No'**
Transfer the guidance to the 'static guidance list'	The guidance remains valid and is designated as static guidance. Literature searches are carried out every 5 years to check whether any of the Medical Technologies Guidance on the static list should be flagged for review.	N/A
Defer the decision to review the guidance	NICE will reconsider whether a review is necessary at the specified date.	N/A
Withdraw the guidance	The Medical Technologies Guidance is no longer valid and is withdrawn.	N/A

Appendix 2 – supporting information

Relevant Institute work

Published

- Acute coronary syndromes (2020) NICE guideline NG185
- Stable angina: management (2011, updated 2016) NICE clinical guideline CG126
- New generation cardiac CT scanners (Aquilion ONE, Brilliance iCT, Discovery CT750 HD and Somatom Definition Flash) for cardiac imaging in people with suspected or known coronary artery disease in whom imaging is difficult with earlier generation CT scanners (2012) NICE diagnostics guidance 3 [updated 2017]

In progress

None identified.

Registered and unpublished trials

The EAC searched for “MiraQ” or “VeriQ” or “Medistim” on clinicaltrials.gov on 03/02/2022 and identified four studies, all of which have been completed.

Appendix 3 – changes to guidance

Table 1: proposed amendments to original guidance

Section of MTG	Original MTG	Proposed amendment
Overview	In February 2018, having originally been developed to make recommendations on the use of VeriQ, this guidance was updated to make recommendations on the use of a follow-on technology, MeriQ. The recommendations, committee considerations and evidence for VeriQ apply to the new technology. The technology name has been changed where relevant from VeriQ to MiraQ. New evidence and updated costs identified during the guidance review are denoted as [2018].	In February 2018, having originally been developed to make recommendations on the use of VeriQ, this guidance was updated to make recommendations on the use of a follow-on technology, MiraQ. The recommendations, committee considerations and evidence for VeriQ apply to the new technology. The technology name has been changed where relevant from VeriQ to MiraQ. New evidence and updated costs identified during the guidance review are denoted as [2018]. A second guidance review was done in 2022 which further reviewed new evidence and updated costs. Updates are denoted as [2022].
1.1	The case for adopting the MiraQ system in the NHS for assessing graft flow during coronary artery bypass graft (CABG) surgery is supported by the evidence. The evidence suggests that intraoperative transit time flow measurement is effective in detecting imperfections that may be corrected by graft revision. This may reduce the incidence of graft occlusion and may reduce perioperative morbidity and mortality.	The MiraQ system is recommended as a cost saving option for assessing graft flow during coronary artery bypass graft surgery.
1.2	The MiraQ system is associated with an estimated cost saving of £141 per patient compared with clinical assessment, when it is used routinely for assessing coronary artery bypass grafts during surgery [2018 – see section 5.12].	[section to be removed to be consistent with current template style and format]
Why the committee made		Clinical evidence shows that using the MiraQ system is effective for assessing coronary artery bypass grafts and allows for grafts to be

these recommendations		revised during surgery. This may reduce the frequency of graft occlusion and may reduce perioperative morbidity and mortality. The MiraQ system can lead to an estimated cost saving of £80.27 per person compared with clinical assessment [2022].
2.4	The cost of the MiraQ system stated in the sponsor's submission includes £32,000 for the VeriQ 2011 console, and £1,582 for each PS probe. These costs have been updated in the 2017 revision of the cost model to £34,000 for the cardiac MCQ0 console and £1,481 for each probe. [2018]	The cost of the MiraQ system stated in the sponsor's submission includes £32,000 for the VeriQ 2011 console, and £1,582 for each PS probe. These costs were updated in the 2017 revision of the cost model to £34,000 for the cardiac MCQ0 console and £1,481 for each probe [2018]. These costs were subsequently updated in the 2021 revision of the cost model, as the MiraQ console and PS probe had increased to £35,955 and £1720, respectively. The annual maintenance cost (assuming 10-year life span) had decreased from £1800 to £1,369.80 [2022].
5.13		For the 2022 guidance review, the EAC reviewed 87 studies which used the Medistim device (MiraQ or previous equivalent versions). It found that most of the evidence was based on single arm studies with large in-between study heterogeneity. There was, therefore, insufficient high-quality evidence to justify any changes to the guidance.
5.14		The EAC revised the model to reflect 2021 costs and changes to the cost of the technology. This led to a reduction in the cost saving from £141 to £80.27 when compared to clinical assessment. The EAC found that there was no justification to update the clinical parameters of the economic model. Further details of the revised model are in the cost update in the review decision.

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