

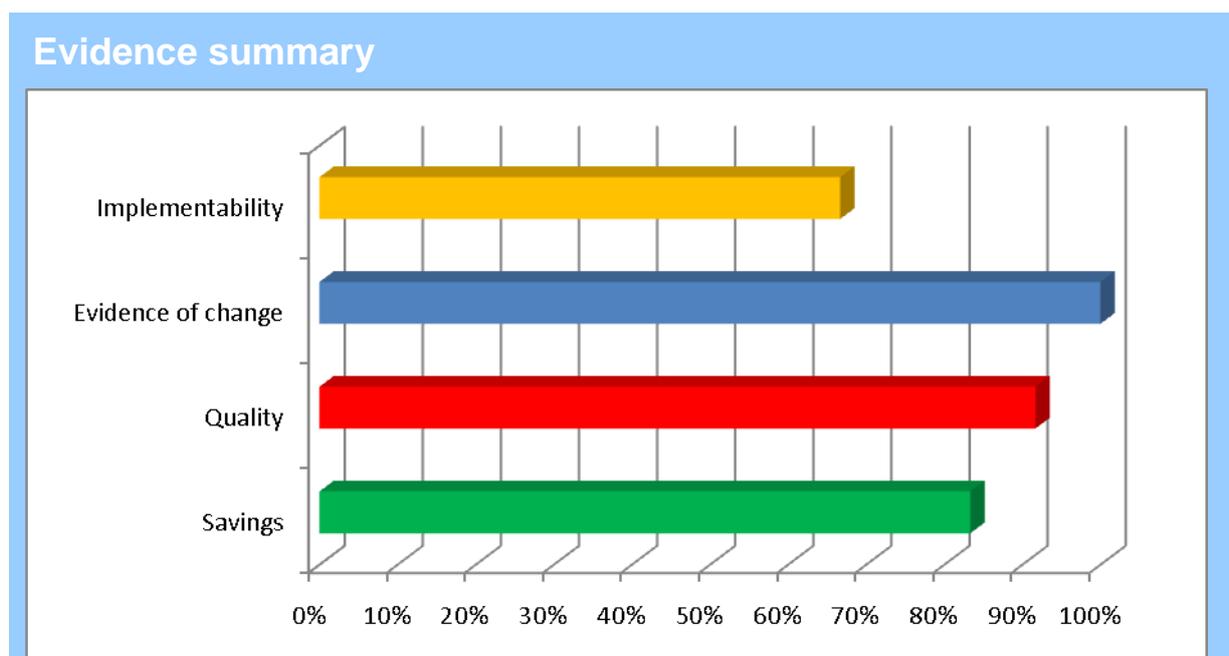
## Oesophageal Doppler-guided fluid management during major surgery: reducing postoperative complications and bed days

Provided by: NHS Technology Adoption Centre

Publication type: National workstream example

QIPP Evidence provides users with practical case studies that address the quality and productivity challenge in health and social care. All examples submitted are evaluated by NICE. This evaluation is based on the degree to which the initiative meets the QIPP criteria of savings, quality, evidence and implementability; each criterion is given a score which are then combined to give an overall score. The overall score is used to identify the best examples, which are then shown on NHS Evidence as 'recommended'.

Our assessment of the degree to which this particular case study meets the criteria is represented in the evidence summary graphic below.



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## Details of initiative

<b>Purpose</b>	To reduce the risk of postoperative complications related to the incorrect administration of intravenous fluid. As a consequence, the mean length of stay in hospital is also reduced.
<b>Description (including scope)</b>	<p>This initiative from the NHS Technology Adoption Centre (NTAC) examined the effects of introducing oesophageal Doppler monitoring (ODM) for fluid administration during major or high risk surgery on length of stay. Barriers to procurement and implementation of the technology were also explored.</p> <p>NICE Medical Technologies Guidance 3 (MTG 3) CardioQ-ODM oesophageal doppler monitor (2011) supports the use of ODM in major or high risk surgery as it has been proven to reduce post operative complications and length of stay.</p> <p>ODM was implemented into clinical practice at three English hospitals and patient outcomes were compared in the 12 months before and after implementation. It was demonstrated that mean length of stay was reduced by 3.6 days with no increase in readmission or reoperation rates.</p> <p>Whilst NICE MTG3 and the NTAC study focussed on a device from one manufacturer, other similar devices may be available now or in the future from other manufacturers.</p> <p>The main barriers encountered were silo budgeting and a lack of confidence using the new technology among anaesthetists. These were overcome by high-level managerial buy-in at each site, and a structured training programme for using ODM.</p>
<b>Topic</b>	Acute/urgent care, planned care, right care, safer care and productive care.
<b>Other information</b>	No further information provided.

## Gate 1: Savings delivered/anticipated

<b>Amount of savings delivered/anticipated</b>	A mean reduction in length of stay of 3.6 days was demonstrated across the three sites following implementation of ODM, as reported in the NHS Technology Adoption Centre (NTAC) How To Why To guide (2011). The results of this study informed the economic assessment in NICE MTG 3 (2011). Based on NICE MTG 3 the anticipated savings are £360 million across England or £700,000 per 100,000 population, after implementation costs.
<b>Type of saving</b>	The savings will be a mixture of cash releasing and improved

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	productivity depending on how individual organisations manage their reduction in bed days.
<b>Any costs required to achieve the savings</b>	<p>From NICE MTG 3 (2011) the cost of implementing this initiative is estimated to be £30 million nationally or £58,000 per 100,000 population.</p> <p>A medium sized trust covering 350,000 population would need to purchase 4–8 monitors. At the time of publication of NICE MTG3 the cost of ODM used in calculations was £11,000 + VAT, with prices subject to volume discounts. The cost has now been reduced significantly and the device manufacturer can provide up-to-date details. A further cost is in disposable oesophageal probes of £60–70 per patient.</p>
<b>Programme budget</b>	Other
<b>Details supporting Gate 1</b>	The economic evidence for this initiative comes from NICE MTG3 (2011), which is based in part on the results of the NTAC implementation study (2011).

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## Gate 2: Quality outcomes

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<b>Impact on clinical quality</b>	Evidence suggests that adoption of ODM for major or high-risk surgery can significantly reduce the incidence of postoperative complications resulting from misadministration of intravenous fluids. This is demonstrated by a reduction in length of stay of 3.6 days. According to NICE MTG3 (2011) current evidence does not support the use of ODM in critical care in preference to other techniques for monitoring cardiac output.
<b>Impact on patient safety</b>	Under this initiative, patient safety is significantly improved as the risk of postoperative complications is reduced, which is reflected in the reduced length of stay. There was no evidence of harm arising from ODM implementation.
<b>Impact on patient and carer experience</b>	The patient experience is improved due to the decreased likelihood of postoperative complications, avoiding a prolonged stay in hospital.
<b>Supporting evidence</b>	Evidence for improvements in clinical quality come from NICE MTG3 (2011) and implementation in three hospitals as demonstrated in the NTAC How To Why To guide for ODM (2011).

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## Gate 3: Evidence of effectiveness

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<b>Evidence base for initiative</b>	<p>NICE MTG3 (2011); see Contacts and Resources.</p> <p>Implementation in three NHS hospitals: a large teaching hospital</p>
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	<p>and a large and a small district general hospital, as reported in the NTAC How To Why To guide for ODM (2011).</p> <p>Numerous randomised controlled trials have reported reduced postoperative complications and length of stay with ODM.</p> <p>Please see Contacts and Resources for further details.</p>
<b>Evidence of deliverable from implementation</b>	<p>Across three hospital sites 649 patients undergoing major surgery following implementation of ODM were compared with 658 patients who had similar operations in the preceding 12 months.</p> <p>Among patients receiving ODM mean cardiac stroke volume increased from 80.7 to 97.2ml indicating increased blood flow consistent with reducing hypovolaemia, and the mean length of stay was reduced significantly by 3.6 days.</p> <p>There were no signs of harm arising from ODM implementation.</p>
<b>Where implemented</b>	<p>Three hospitals chosen for their different sizes, geographical location and case-mix. The Whittington is a university-associated district general hospital in London, Royal Derby Hospital is a large regional hospital and Manchester Royal Infirmary is a tertiary centre.</p>
<b>Degree to which the actual benefits matched assumptions</b>	<p>The benefits realised matched those anticipated.</p>
<b>If initiative has been replicated how frequently/widely has it been replicated</b>	<p>Controlled implementation is taking place as part of enhanced recovery programmes in a number of English regions supported by NTAC as part of the Innovative Technology Adoption Procurement Programme (iTAPP).</p>
<b>Supporting evidence for Gate 3</b>	<p>No further information provided.</p>

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## Gate 4: Details of implementation

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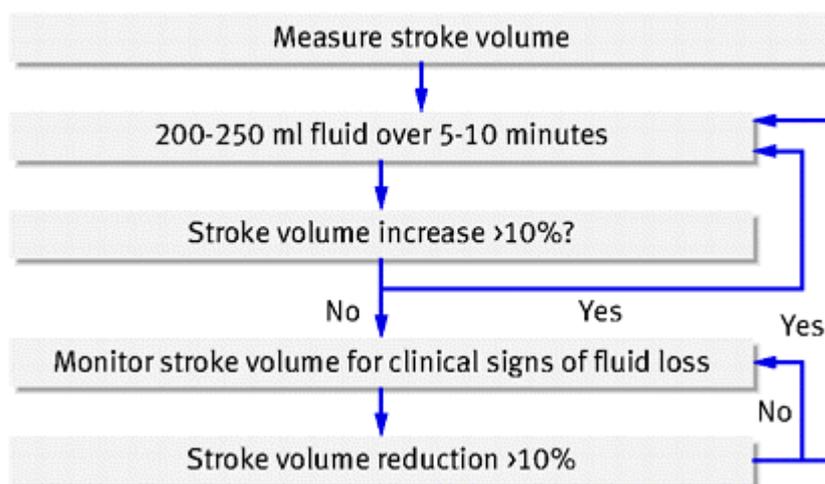
<b>Implementation details</b>	<p>Despite a large evidence base demonstrating significantly improved surgical outcomes, uptake of ODM has been poor across the NHS. In late 2007 this technology was selected by NTAC for an implementation project to understand and overcome the barriers to widespread adoption of ODM.</p> <p>Three NHS hospitals were chosen to take part in this initiative based on their different size, location and case-mix. At each site, a project team combining a lead clinician, managers and audit facilitator devised a project plan together with support from an NTAC programme manager. The approach to implementation</p>
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was tailored to the diverse surgical activity at each site.

At each site NTAC funded a nurse or audit facilitator to collect data, and implementation was encouraged by regular feedback to the anaesthetists. Regular meetings between anaesthetists and the project team at each site encouraged feedback and helped troubleshooting. After classroom and in-theatre training, anaesthetists were encouraged to use ODM-guided intravenous fluid in all eligible cases according to a fluid administration algorithm shown below:



**Fig 1** Intraoperative fluid management using stroke volume optimisation technique with oesophageal Doppler monitoring

Although ODM use could not be mandated, no anaesthetists refused to use the Doppler monitor or stated that they felt unable to use the monitor after training. After implementation 65% of patients had ODM utilised, compared with 11% pre-implementation. This represents a substantial increase in real world utilisation.

At Royal Derby Hospital, ODM was implemented in colorectal surgery. The colloid used was Gelofusine (Braun). Overlapping committee responsibilities proved a significant hurdle; the Equipment, Change in Practice, Audit and Directorate Management committees were all involved in project conduct. An executive sponsor at the Trust board level proved crucial in encouraging clinicians and managers to work together and generate organisational momentum. Overcoming silo budgeting was facilitated by a directorate reorganisation giving one manager responsibility for both surgical wards and operating theatres.

At Manchester Royal Infirmary, Doppler use was encouraged for a wide range of major elective and emergency surgical procedures. However, implementation was limited to a subset of clinical teams to maintain control of costs. Fourteen consultant anaesthetists volunteered to champion ODM use and report

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perioperative outcomes. These data were compared with procedures of similar severity undertaken by the same clinical teams in the 12 months before implementation. The colloid used was Volulyte (Fresenius Kabi).

At the Whittington, ODM was implemented in colorectal and orthopaedic surgery. The colloid used was Gelofusine. Use by 18 consultants and two staff grades was encouraged in all eligible cases. In addition to training for permanent staff, ODM instruction was introduced to the trainee induction programme. At the Whittington and in elective colorectal surgery only, Doppler implementation occurred as part of implementation of a multidisciplinary multimodal enhanced recovery programme.

Overall 649 patients undergoing major surgery following implementation of ODM (Intervention) were compared with 658 patients (Controls) who had similar operations in the preceding 12 months. Patient characteristics and surgical speciality were recorded in both groups; the preoperative assessment scores using Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM) and urgency of surgery, were similar.

Data for the postoperative length of stay is provided below, demonstrating a significant difference between the intervention and control groups (p-value 0.001, independent t-test):

Group	N	Mean length of stay (days)	Standard deviation
Intervention	649	13.6	15.9
Control	658	17.2	24.0

The results of this study demonstrate that use of ODM can significantly reduce length of stay, particularly among patients undergoing major or high risk surgery. This is consistent with NICE MTG3.

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**Time taken to implement**

It may take between 3 months and 1 year to implement the initiative.

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**Ease of implementation**

This initiative affects multiple departments within a hospital as it requires cooperation from surgical teams, management and procurement.

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**Level of support and commitment**

Support is required from the staff noted above. The experience of NTAC indicates that there is likely to be resistance from managers if the case for cost or efficiency savings is not made clearly.

A survey of clinicians before implementation showed that most accepted the benefits of ODM but were concerned they lacked training to use the devices confidently.

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## Barriers to implementation

It is necessary to develop a strong business case and obtain managerial support at a high level to overcome silo budgetary concerns, where costs and benefits are not spread equally among departments.

There may be scepticism about the technology from surgical and anaesthetic teams, and positioning and focusing the oesophageal probes correctly can be challenging. These issues may be overcome through peer-led training both in theatre and in the anaesthetic department, to give anaesthetists confidence in using ODM. A structured and certified training programme which can include additional 'doctor to doctor' support is provided free of charge by the supplier.

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## Risks

Risk of complication and death was estimated using Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM), which incorporates patient-related and surgical risk factors.

There was no sign of harm arising from ODM implementation.

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## Supporting evidence for Gate 4

A detailed account of implementation is provided by the NTAC How To Why To guide (2011). Please see Contacts and Resources below.

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## Further evidence

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### Dependencies

Capital equipment purchase subject to business case approval and training.

Benchmark data for benefitting patient population, namely length of stay, frequency or readmission, mortality, admissions and length of critical care stay.

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## Contacts and resources

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### Contacts and resources

NTAC How to Why to Guide (2011) available at [www.howtowhyto.nhs.uk](http://www.howtowhyto.nhs.uk)  
<http://www.ntac.nhs.uk/HowToWhyToGuides/DopplerGuidedIntraoperative/Doppler-Executive-Summary.aspx>

MTG3 CardioQ-ODM oesophageal doppler monitor (2011)  
National Institute for Health and Clinical Excellence.  
<http://guidance.nice.org.uk/MTG3>

Further resources:

Abbas SM, Hill AG. Systematic review of the literature for the use of oesophageal Doppler monitor for fluid replacement in major abdominal surgery. *Anaesthesia* 2008;63(1):44-51

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Khuri SF, Henderson WG, DePalma RG, Mosca C, Healey NA, Kumbhani DJ. Determinants of long-term survival after major surgery and the adverse effect of postoperative complications. *Ann Surg* 2005;242(3):326-41

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Sinclair S, James S, Singer M. Intraoperative intravascular volume optimisation and length of hospital stay after repair of proximal femoral fracture: randomised controlled trial *Br Med J* 1997;315(7113):909-12

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Wakeling HG, McFall MR, Jenkins CS, Woods WG, Miles WF, Barclay GR, et al. Intraoperative oesophageal Doppler guided fluid management shortens postoperative hospital stay after major bowel surgery. *Br J Anaesth* 2005;95(5):634-42

If you require any further information please email: [contactus@evidence.nhs.uk](mailto:contactus@evidence.nhs.uk) and we will forward your enquiry and contact details to the provider of this case study. Please quote QIPP reference 11/0013 in your email.

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