‘Out in the cold?’

An audit cycle of perioperative temperature management in a British day surgery unit, in response to the publication of NICE guidelines on the perioperative management of inadvertent hypothermia in adults

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Keywords: hypothermia, guidelines, cost.

Abstract

Introduction: Hypothermia is a common perioperative complication which can potentially increase the risk of perioperative morbidity. In the UK, the National Institute for Clinical Excellence (NICE) published guidelines for the management of inadvertent perioperative hypothermia in 2008. These guidelines have a weak evidence base in the day surgery setting. This audit cycle assessed our Day Surgery Unit’s adherence to the guidelines, their cost implications and relevance when applied to our patient cohort.

Method: A total of 211 patients attending for day surgery were assessed in two separate two week winter periods which were one year apart. Temperatures were taken preoperatively, intraoperatively and in recovery.

Results: 99.0% (2008) and 100% (2009) of patients were warm prior to induction. 66.0% (2008) and 50.0% (2009) of patients fulfilled NICE criteria for intraoperative warming, but in only 3 patients was this instigated.

6.5% (2008) and 7.6% (2009) of all patients were cold on arrival in the recovery room. None were warmed. No adverse events were recorded in these patients.

Discussion: We conclude that outcomes in our unit remain good despite lack of full adoption of NICE guidelines. We now provide written information to patients regarding perioperative temperature control, keep them dressed and mobile until as close to induction of anaesthesia as possible and ensure a warm waiting room. Patients are worn if needed for comfort perioperatively but they are not routinely and formally risk stratified. We feel that it is difficult to justify the cost of full implementation of the guidelines which calculated on current activity would amount to £94,500 per annum.

Introduction

Since the publication of guidance from the National Institute for Health and Clinical Excellence (NICE) on the management of inadvertent perioperative hypothermia in 2008, there has been an increased awareness of the problems caused by a low core temperature in the perioperative period. The guidelines define perioperative hypothermia as a core temperature below 36.0°C at any time from one hour prior to the start of anaesthesia to 24 hours after entering the post operative recovery room. Hypothermia remains a common problem for the in-patient surgical population, despite easy interventions to either treat or prevent it.

There is good evidence that hypothermia can cause physiological derangements affecting multiple organs that can increase perioperative morbidity. These include an increased rate of adverse cardiac events (6.3% v 1.4%), increased blood loss (16%) and increased relative risk for blood transfusion (22%). There is also evidence to suggest that there is an increased rate of wound infection (19% v 6%), prolonged stay in recovery (94 minutes v 53 minutes) and prolonged hospital stay (increase of 2.6 days).

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There has been some discussion as to the relevance of the NICE guidelines to the day surgery patient population. One audit found that 40% of patients became hypothermic after day surgery, increasing to 52% when surgery lasted more than one hour, apparently favouring the application of NICE guidelines. Implementation of the NICE guidelines clearly has economic implications but NICE argues that the cost of implementing the guidelines can be largely offset against the resulting reduction in blood transfusion requirements, cardiac complications and wound infections. Whilst clearly relevant for major in-patient surgery, or surgery for high risk patients, such events are less likely and certainly less common in the day surgery setting.

This audit cycle was designed to assess the incidence of hypothermia in patients attending Torbay Hospital Day Surgery Unit and the compliance with NICE guidance. The data was also used to consider cost implications and relevance of the NICE guidelines to our day surgery patient cohort.

Methods

Audit one was conducted over a two week period in December 2008, aiming to capture all adult patients undergoing general or regional anaesthesia in the three day surgery theatres in Torbay Hospital's Day Surgery Unit. Audit two, a re-audit, was conducted in November and December 2009 for a further two week period. Our audit standard was based on the 14 criteria of the 2008 NICE guidelines (Table 1), although not all criteria were tested.

A paper based questionnaire was used to collect patient demographic data and temperature recordings on admission to the unit, on arrival in the anaesthetic room and finally on arrival in primary recovery. A chi-squared test was used to determine whether duration of time in theatre had any effect on postoperative temperature. Information on the use of active warming devices and postoperative shivering were also recorded. The data collection was performed by the day surgery nursing staff, operating department practitioners and anaesthetists. Additional details were obtained from our electronic patient record, Daynamix® Calcium Systems in 2008 and Galaxy Surgery® (Soft Ltd) and Anaesthesia Manager® (PICIS) in 2009.

All temperatures were recorded using a SureTemp® Plus 690 electronic thermometer. Sublingual temperatures were recorded on admission and in the anaesthetic room. The axilla was most frequently used in recovery due to patient compliance. Patients were telephoned the following day, which is standard practice for all patients treated in our unit to assess satisfaction and elicit any complications including pain, nausea and vomiting.

Following the initial audit in 2008, as per NICE guidance, new written information was provided to the patients during preoperative assessment explaining the need to keep warm prior to surgery. The written information described the risk of hypothermia and asked them to bring in warm clothes and to inform the nursing staff if they felt cold. Additionally, following the initial audit, results obtained were presented and made available to staff within the Day Surgery Unit, to provide education on the NICE guidelines and their relevance to practice in their working environment.

Results

One hundred and eleven patients were included in the initial audit, and 118 patients were included in the re-audit in 2009: a total of 229 patients. Of these, complete data was obtained for 211 patients.

Preoperative Phase

The populations were typical of those expected in day surgery with the majority of patients ASA I and II (Table 2).

<table>
<thead>
<tr>
<th>ASA</th>
<th>Number in 2008</th>
<th>Number in 2009</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>82 (73.9%)</td>
<td>77 (65.2%)</td>
</tr>
<tr>
<td>2</td>
<td>28 (25.2%)</td>
<td>34 (28.8%)</td>
</tr>
<tr>
<td>3</td>
<td>1 (0.9%)</td>
<td>7 (5.9%)</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
<td>118</td>
</tr>
</tbody>
</table>

According to NICE guidance, patients of ASA 2-5 are at higher risk of hypothermia and this is regarded as one risk factor. Our results showed that 29/111 (26%) in 2008 and 41/118 (35%) in 2009 had ASA as a risk factor for hypothermia.

Temperature distribution on admission to the day surgery unit and on arrival in the anaesthetic room is shown in Table 3. As per NICE guidelines, no preoperative warming was required in 99% of patients in 2008. In the re-audit in 2009 only one patient had a temperature less than 36.0°C (35.9°C) on arrival to the unit, and without any active warming this had increased to 36.7°C on arrival in the anaesthetic room.

Intraoperative Phase

NICE guidelines highlight patients at higher risk of hypothermia (Criteria 4 of NICE Guidelines – see Table 1) and recommend pre-emptive warming of any patient with two or more risk factors. Those falling into the higher risk category in our day surgery population did so by virtue of being both ASA 2-5 and having intermediate surgery. Seven (7.5%) of patients had both risk factors in 2008 and 14 (11%) had both risk factors in 2009.

In addition NICE recommend that any patient undergoing
<table>
<thead>
<tr>
<th>Criterion</th>
<th>Details</th>
</tr>
</thead>
</table>
| Criterion 1 | Patients should be offered written information about:  
- the treatment and care they should be offered, including the Understanding NICE guidance booklet  
- the service providing their treatment and care  
- the importance of staying warm before surgery to lower the risk of postoperative complications  
- the possibility of the hospital environment being colder than their home  
- bringing additional clothing, such as a dressing gown, vest, warm clothing and slippers, to help them keep warm comfortably  
- the importance of telling staff if they feel cold at any time during their hospital stay. |
| Criterion 2 | Families and carers should be offered written information about:  
- the treatment and care they should be offered, including the 'Understanding NICE guidance' booklet  
- the service providing the patient's treatment and care  
- the importance of staying warm before surgery to lower the risk of postoperative complications  
- the possibility of the hospital environment being colder than their home  
- bringing additional clothing, such as a dressing gown, vest, warm clothing and slippers, to help them keep warm comfortably  
| Criterion 3 | Patients should be assessed for their risk of inadvertent peri-operative hypothermia and potential adverse consequences before transfer to the theatre suite. |
| Criterion 4 | Patients should be managed as higher risk if any two of the following apply:  
- ASA grade II to V  
- pre-operative temperature below 36.0°C (and pre-operative warming is not possible because of clinical urgency)  
- undergoing combined general and regional anaesthesia  
- undergoing major or intermediate surgery  
- at risk of cardiovascular complications. |
| Criterion 5 | Patients' temperature should be measured and documented in the hour before they leave the ward or emergency department. |
| Criterion 6 | Patients whose temperature is below 36.0°C should have:  
- forced air warming started pre-operatively on the ward or in the emergency department  
- forced air warming maintained throughout the intraoperative phase. |
| Criterion 7 | Patients' temperature should be measured and documented before induction of anaesthesia and then every 30 minutes until the end of surgery. |
| Criterion 8 | Patients' temperature should be 36°C or above before induction of anaesthesia. |
| Criterion 9 | The following patients should be warmed intraoperatively from induction of anaesthesia using a forced air warming device:  
- those at higher risk of inadvertent peri-operative hypothermia and who are having anaesthesia for less than 30 minutes  
- those having anaesthesia for longer than 30 minutes. |
| Criterion 10 | Patient's temperature should be measured and documented on admission to the recovery room and then at 15-minute intervals. |
| Criterion 11 | Ward transfer should not be arranged unless the patient's temperature is 36.0°C or above. |
| Criterion 12 | Patients whose temperature is below 36.0°C postoperatively should be actively warmed using forced air warming until they are discharged from the recovery room or until they are comfortably warm. |
| Criterion 13 | Healthcare professionals who measure patients' temperature with any device should:  
- be aware of, and carry out, any adjustments that need to be made in order to obtain an estimate of core temperature from that recorded at the site of measurements  
- be aware of any adjustments that are made automatically by the device used. |
| Criterion 14 | Intravenous fluids of 500ml or more and blood products should be warmed to 37°C using a fluid warming device. |
Table 3 Temperature distribution on admission to the Day Surgery Unit and on arrival in the anaesthetic room.

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Admission</td>
<td>Anaesthetic Room</td>
</tr>
<tr>
<td>&gt;36.5</td>
<td>76 [81.7%]</td>
<td>65 [69.9%]</td>
</tr>
<tr>
<td>36.0-36.4</td>
<td>17 [18.3%]</td>
<td>27 [29.0%]</td>
</tr>
<tr>
<td>&lt;36.0</td>
<td>0 [1.1%]</td>
<td>1 [0.8%]</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>93</td>
</tr>
</tbody>
</table>

surgery lasting 30 minutes or more should have peroperative warming (criteria 9). If the presence of two risk factors and/or anaesthesia for 30 minutes or more are considered, in 2008, a total of 65.0% and in 2009, 50.0% of cases should have been pre-emptively warmed from induction of anaesthesia if NICE guidelines were fully instituted within our unit. In 2008, no patients had active warming in theatre. In 2009, three patients had a forced air warmer applied intraperatively. None of these patients had temperatures less than 36.0°C prior to surgery. Two fulfilled NICE criteria for pre-emptive warming and all spent at least 59 minutes in theatre.

Theatre time was typical for a day surgery population and is shown in Table 4. Table 5 shows the relationship between the time spent in theatre and the incidence of hypothermia in the recovery period. When comparing recovery temperatures for those in theatre for less than 30 minutes with those in theatre for 30 minutes or more, no statistically significant difference was found between the groups. (p = 0.41)

NICE also recommends the warming of any fluids infused in volumes of 500ml or over. It is standard protocol in our unit to infuse one litre of crystallised to adult patients undergoing general anaesthesia. This is not routinely warmed.

Recovery Phase
In 2008 6 (6.5%) patients had a temperature of less than 36.0°C on arrival in primary recovery. None of these patients had the combination of pre-operative risk factors suggested by NICE guidance to indicate the need for intraoperative warming. One patient was cold in the anaesthetic room at 35.8°C. Three were anaesthetised for greater than 30 minutes, with only one of these anaesthetics predicted to last greater than 30 minutes. None were actively warmed in theatre or recovery. There was no evidence at follow up of any adverse effects in terms of unplanned admission to hospital, patient satisfaction or pain scores. Three different patients were warmed in recovery as they felt subjectively cold but none had temperatures of less than 36.0°C.

During the re-audit, 9 [7.6%] patients had a temperature of less than 36.0°C on entering primary recovery. One of these patients had preoperative risk factors which would have indicated the need for intraoperative warming. None of these patients had either forced air warming or fluid warming in theatre. Three were anaesthetised for greater than 30 minutes. One of these patients had forced air warming in recovery and their temperature rose to 36.5°C within 20 minutes. At follow up, one of these patients reported poor patient satisfaction but the specific reason was unclear.

In 2009 four different patients were recorded as shivering on arrival in primary recovery. Of these, none had temperatures less than 36.0°C however one was noted to feel subjectively cold, and 2 patients were given forced air warmers. No patients were admitted due to inadvertent hypothermia.

Table 4 Mean time in theatre and mean surgical time.

<table>
<thead>
<tr>
<th>Mean Time in:</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theatre (minutes)</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>Surgery (minutes)</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>Number of patients in theatre 30 minutes or longer</td>
<td>61 [65.0%]</td>
<td>59 [50.0%]</td>
</tr>
</tbody>
</table>

Table 5 Time spent in the operating theatre and the number of patients who were hypothermic after this time.

<table>
<thead>
<tr>
<th>Time in theatre (minutes)</th>
<th>Number of patients</th>
<th>Number hypothermic (&lt;36°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>91</td>
<td>8 [8.8%]</td>
</tr>
<tr>
<td>30-59</td>
<td>93</td>
<td>3 [3.2%]</td>
</tr>
<tr>
<td>60-89</td>
<td>23</td>
<td>3 [13.0%]</td>
</tr>
<tr>
<td>90-120</td>
<td>4</td>
<td>1 [25.0%]</td>
</tr>
</tbody>
</table>
Table 6 Patient temperatures on arrival in primary recovery

<table>
<thead>
<tr>
<th>Recovery</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;36.5°C</td>
<td>47 (50.5%)</td>
<td>54 (65.8%)</td>
</tr>
<tr>
<td>36-36.5°C</td>
<td>40 (43.0%)</td>
<td>55 (66.6%)</td>
</tr>
<tr>
<td>&lt;36°C</td>
<td>6 (6.5%)</td>
<td>9 (7.6%)</td>
</tr>
<tr>
<td>Number warmed</td>
<td>3 (3.2%)</td>
<td>3 (2.5%)</td>
</tr>
</tbody>
</table>

**Discussion**

Our audit cycle has shown that inadvertent peri-operative hypothermia is uncommon in Torbay Hospital Day Surgery Unit in contrast to other studies despite lack of full adoption of the NICE guidelines. There was also very limited evidence of any morbidity associated with any of the cases of recorded postoperative hypothermia, and certainly no increase in unplanned hospital admission following surgery. This raises the question are the NICE guidelines on hypothermia relevant to our day surgery population?

The reasons for the observations in this audit cycle could be numerous. Day case patients undoubtedly have different characteristics to in-patients, being elective admissions and thus not acutely unwell with the associated problems that acute illnesses pose. Anaesthetic and surgical techniques are different and refined, with minimally invasive procedures and rapid onset and offset anaesthetic techniques the norm.

Pre-operatively, written guidance has now been included on patient information leaflets, thus fulfilling NICE criteria simply and cost effectively. The waiting area is kept warm at approximately 21°C. Unit policy is also to keep patients mobile and change them into surgical gowns as close to induction as possible. This practice appears to work and the results show that patients are arriving warm in the anaesthetic room.

Intraoperatively forced air warming would be recommended in 57% of patients when combining results from 2008 and 2009, and fluid warming in 100% of patients undergoing general anaesthesia if unit protocol was adhered to. In spite of this not being implemented, no complications were observed in any of the patients included in the audit. There was no statistically significant relationship between time spent in theatre and the number of patients arriving in primary recovery with hypothermia - indicating that time in theatre may be an inappropriate criterion for the instigation of forced air warming in day surgery patients.

In 2008 and 2009, a few patients, 6 (6.5%) and 9 (7.6%) respectively, arrived in primary recovery with temperatures of less than 36.0°C. Only three of these patients had potentially predictable peri-operative characteristics and no adverse events were recorded. This is significantly less than that reported by Boyle et al, where 40% of their patients were hypothermic. However they reported that hypothermia appears to have been well tolerated in their day case population as no adverse consequences were reported during their audit period. Our findings would reflect this observation.

The cost implications of fully implementing NICE guidelines are not insignificant. In our day surgery unit, based on the results of this audit and current equipment costs within the trust, costs would have amounted annually to up to £49 500 for forced air warming and £45 000 for fluid warming. From the results of our audit and the work of others there appears to be limited evidence to suggest that inadvertent hypothermia causes actual harm to day surgery patients. The NICE suggestion that the additional cost of full implementation of the inadvertent hypothermia guidelines would be offset against the resulting reduction in wound infections, cardiac complications and blood transfusion requirements appears not to be supported in the day surgery population (although we have not audited wound infections). There is perhaps a case that day surgery should have its own guidelines or acknowledged as exempted from the current guidelines. Of relevance and potentially in support of this, on closer examination of the full NICE guideline the following disclaimer can be found which attention should perhaps be paid before rushing to implement NICE guidance on hypothermia 'across the board'.

**Disclaimer**

As with any clinical practice guideline, the recommendations contained in this guideline may not be appropriate in all circumstances. A limitation of a guideline is that it simplifies clinical decision making. Decisions to adopt any particular recommendations must be made by practitioners in the context of:

- Available resources
- Local services, policies and protocols
- The circumstances and wishes of the patient
- Available personnel and devices
- Clinical experience of the practitioner
- Knowledge of more recent research findings

The intention of our department is, therefore to:

- Continue to provide written information to patients regarding the risk of hypothermia
- Continue the successful practice of maintaining a warm waiting area, keeping patients mobile preoperatively and changing into theatre gowns as close to induction as possible
- Record patient temperatures in the anaesthetic room and in recovery
- Provide warming if needed or for patient comfort
We are not however pre-emptively warming all patients identified by NICE guidelines as it appears that the cost is not justified. This was similarly observed in a non-day surgery setting and in ENT patients. Evidence to support the use of NICE hypothermia recommendations in the day surgery setting remains weak. When assessing the financial commitment in implementing these NICE guidelines across our whole day surgery patient population, there does not appear to be adequate evidence that patient outcome is adversely affected by their selective omission.

References


