Nasogastric tubes: An update on patient safety

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7th Gastrointestinal Nursing Conference
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The NHS must learn from its mistakes

Sharing knowledge and spreading expertise will improve patient safety

Maurice Murphy died after a nasogastric tube was passed through his nose into his lung instead of into his stomach. Murphy, the principal trumpet of the London Symphony Orchestra for 30 years, was being treated in an NHS hospital in London for a liver complaint. A junior nurse who queried whether the tube was in the right place was told by the doctor in charge: "You don't have the brain to
NG Tube:
It's How I Get
My Dinner
History of the NG Tube

• First described by Hunter in 1790
• Fed a patient via a flexible hollow leather tube inserted into the stomach
• Tube made of eel skin that had been stretched over whale bone
• The patient had a stroke and was fed utilizing the tube for 5 weeks.
• Reported the case to the Society for Improvement of Medical and Chirurgical Knowledge.
History of the NG Tube (2)

- 1976 - weighted Dobhoff tube
- 1980 - inner guidewire introduced
- Devpt of enteral formulas
- Devpt of several feeding tubes
- EBM - metabolic, costs, safety
- Fine bore softer tubes
Indications for NG feeding

- Malnourished or at risk of malnutrition
- Inadequate or unsafe oral intake
- Functional and accessible GI tract

NICE 2007
April 2004 - an inquest

- 8 yr-old female; unexpected death
- Ventilated with respiratory failure
- NG for feeding
- Position check: whoosh test + litmus paper went pink
- Feed started and ventilation worsened
- Rpt whoosh and litmus; continue feed.
- RIP
Inquest

• Post mortem
  – large quantity of feed in pleural cavity
  – the tip of NGT had punctured the pleura to lie in the pleural cavity
• Coroner: issued a notice to NHS
• Sought to avoid a recurrence.
Medical Device Alert

Enteral feeding tubes (nasogastric) Ref. MDA/2004/026

The Medicines and Healthcare products Regulatory Agency (MHRA) have recently issued an alert relating to the checking of nasogastric tube placement. Blue litmus paper is commonly used to test aspirate to ensure the correct positioning of a nasogastric tube. Blue litmus paper will turn pink in the presence of acid regardless of the level of acidity (i.e., pH 7) and is not sufficiently sensitive to distinguish between the pH of different fluids, specifically between bronchial and gastric secretions.

There is the potential for a malpositioned nasogastric tube to go undetected if blue litmus paper is used as the method of checking placement. The MHRA are aware of an incident where this has occurred and contributed to the death of a patient.

As a result the MHRA have stated that pH indicator paper should be used in place of blue litmus paper and have issued the following guidance:

- Define expected pH range for secretions to be tested such as gastric and bronchial secretions, giving consideration to variables such as the use of antacids and proton pump inhibitors.
- Select the appropriate paper for your requirements. pH indicator paper is available in several ranges and graduations of pH.
- Follow the instructions for use provided by the manufacturer of the pH indicator paper and the nasogastric tube.
- Ensure all staff are appropriately trained in the use of the pH indicator paper and the interpretation of the results.

Trusts need to ensure that action has been taken by October 2004.

The National Nutrition Nurses Group (NNNG) can be contacted for clinical guidance.

For further details on this alert visit www.mhra.gov.uk
# Patient safety alert 05

**Reducing the harm caused by misplaced nasogastric feeding tubes**

Nasogastric tube feeding is common practice in all age groups, from neonates to older people. Thousands of feeding tubes are inserted daily without incident. However, there is a small risk that the nasogastric feeding tube can be misplaced into the lungs during insertion, or move out of the stomach at a later stage. Although misplacement can be recognised at an early stage, i.e. before the tube is used, studies have shown that conventional methods used to check the placement of nasogastric feeding tubes can be inaccurate. The NPSA is aware of 11 deaths and one case of serious harm due to misplaced nasogastric feeding tubes over a two-year period.

**Action for the NHS**

NHS acute trusts, primary care organisations and local health boards in England and Wales should take the following steps immediately:

1. Provide staff, carers and patients in the community, with information on correct and incorrect testing methods:
   - measuring the pH of aspirate using pH indicator strips/paper is recommended;
   - radiography is recommended but should not be used ‘routinely’. Local policies are recommended for particular groups of patients e.g. those in intensive care units and neonates. Fully radio-opaque tubes with markings to enable accurate measurement, identification and documentation of their position should be used;
   - DO NOT use the ‘whoosh’ test - this practice must cease immediately;
   - DO NOT test acidity/alkalinity of aspirate using blue litmus paper;
   - DO NOT interpret absence of respiratory distress as an indicator of correct positioning.
2. Carry out individual risk assessment prior to nasogastric tube feeding.
3. Review and agree local action required.
4. Report misplacement incidents via their local risk management reporting systems.

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<table>
<thead>
<tr>
<th>Immediate action</th>
<th>✔</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Update</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>Information request</td>
<td>□</td>
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</tr>
</tbody>
</table>
Testing the position of nasogastric feeding tubes

Methods that should be used:
- measuring the pH of aspirate using pH indicator strips/paper;
- radiography.

Methods that should NOT be used:
- auscultation of air insufflated through the feeding tube (‘whoosh’ test);
- testing the acidity/alkalinity of aspirate using blue litmus paper;
- interpreting absence of respiratory distress as an indicator of correct positioning;
- monitoring bubbling at the end of the tube;
- observing the appearance of feeding tube aspirate.
Between NPSA 2005-2010

- 21 deaths
- 79 cases of serious harm
- Misinterpretation of CXR: 45 cases / 12 deaths
- Feeding despite pH 6-8: 7 cases / 2 deaths
- No position checks: 9 cases / 1 death.
Table 1: Summary of all reported incidents relating to misplaced nasogastric feeding tubes between September 2005 and 31 March 2010

<table>
<thead>
<tr>
<th>Checking method where error occurred</th>
<th>Total number of reported incidents</th>
<th>Number of reported deaths (out of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-ray misinterpretation</td>
<td>45</td>
<td>12</td>
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<tr>
<td>Fed despite aspirate tested as pH 6-8 (i.e. existing advice ignored)</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Fed after apparently obtaining pH 1-5.5*</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Water instilled down nasogastric tube before testing pH (i.e. existing advice ignored)</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Not checked at all</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Apparent migration after initially correct placement (e.g. after suction)</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>No information obtained on checking method used</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Placed under endoscopic guidance</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>• Visual appearance of aspirate</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>• Bubble test</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>21</td>
</tr>
</tbody>
</table>

* note almost none of these pH levels were contemporaneously recorded but were recalled by staff during subsequent local investigation
Reducing the harm caused by misplaced nasogastric feeding tubes in adults, children and infants

This Alert updates and strengthens Patient Safety Alert 05 (*Reducing the harm caused by misplaced nasogastric feeding tubes*) and is based on national learning since then. It does not replace *Reducing the harm caused by misplaced naso and orogastric feeding tubes in babies under the care of neonatal units*, issued in August 2005.

Patient Safety Alert 05 provided guidance for the NHS on checking and confirming that a nasogastric tube had been inserted into the right place, i.e. the stomach.

Action for the NHS

For action by all organisations in the NHS and independent sector where nasogastric feeding tubes are placed and used for feeding patients.

An executive director, nominated by the chief executive, working with relevant medical and nursing staff should ensure, through reviewing policies, procedures and staff training that by **12 September 2011**:

1. A named clinical lead is assigned to have responsibility for implementing all actions in this Alert.

2. All policies, protocols, and bedside documentation are reviewed to ensure compliance with steps (a) to (j) outlined on page 2 every time a nasogastric tube is inserted and used to administer feeding.
Aspirate obtained?

YES

Try each of these techniques to help gain aspirate:
- If possible, turn adult onto left side
- Inject 10-20ml air into the tube using a 50ml syringe
- Wait for 15-30 minutes before aspirating again
- Advance or withdraw tube by 10-20cm
- Give mouth care to patients who are nil by mouth (stimulates gastric secretion of acid)
- Do not use water to flush

NO

Test aspirate on CE marked pH indicator paper for use on human gastric aspirate

pH between 1 and 5.5

YES

Aspirate obtained?

YES

pH NOT between 1 and 5.5

NO

Proceed to x-ray: ensure reason for x-ray documented on request form

Competent clinician (with evidence of training) to document confirmation of nasogastric tube position in stomach

YES

DO NOT FEED or USE TUBE
Consider re-siting tube or call for senior advice
To be a “never event”, an incident must fulfill the following criteria:

• The incident has clear potential for or has caused severe harm/death.
• There is evidence of occurrence in the past (i.e. it is a known source of risk).
Criteria for a ‘never event’ (2)

• There is existing national guidance and/or national safety recommendations on how the event can be prevented and support for implementation.

• The event is largely preventable if the guidance is implemented.

• Occurrence can be easily defined, identified and continually measured.
13. Misplaced naso- or oro-gastric tubes

Misplacement and use of a naso- or oro-gastric tube in the pleura or respiratory tract where the misplacement of the tube is not detected prior to commencement of feeding, flush or medication administration.

Setting: All patients receiving NHS funded care.

Guidance:
- Patient safety alert – Reducing harm caused by misplaced naso and orogastric feeding tubes in babies under the care of neonatal units, 2005, available at http://www.nrls.npsa.nhs.uk/resources/?entryId45=59798&q=0%c2%acnasogastric%c2%ac
- Harm from flushing of naso-gastric tubes before confirmation of placement, 2012. available at http://www.nrls.npsa.nhs.uk/resources/?entryId45=133441

Patient safety alert on placement devices for nasogastric tube insertion - http://www.england.nhs.uk/2013/12/05/psa-ng-tube/

14. Scalding of patients

Patient being scalded by water used for washing/bathing.
95 incidents/32 deaths Sept 2011-March 2016

Patient Safety Alert

Nasogastric tube misplacement: continuing risk of death and severe harm
22 July 2016

Alert reference number: NHS/PSA/RE/2016/006
Alert stage: Two - Resources

Use of misplaced nasogastric and orogastric tubes was first recognised as a patient safety issue by the National Patient Safety Agency (NPSA) in 2005 and three further alerts were issued by the NPSA and NHS England between 2011 and 2013. Introducing fluids or medication into the respiratory tract or pleura via a misplaced nasogastric or orogastric tube is a Never Event. Never Events are considered 'wholly preventable where guidance or safety recommendations that provide strong systemic protective barrier are available at a national level, and should have been implemented by all healthcare providers.'

Between September 2011 and March 2016, 95 incidents were reported to the National Reporting and Learning System (NRLS) and/or the Strategic Executive Information System (StEIS) where fluids or medication were introduced into the respiratory tract or pleura via a misplaced nasogastric or orogastric tube. While this should be considered in the context of over 3 million nasogastric or orogastric tubes being used in the NHS in that period, these incidents show that risks to patient safety persist. Checking tube placement before use via pH testing of aspirate and, when necessary, x-ray imaging, is essential in preventing harm.

Examination of these incident reports by NHS Improvement clinical reviewers shows that misinterpretation of x-rays by medical staff who did not appear to have received the competency-based training required by the 2011 NPSA alert is the most common error type. Other error types involve nursing staff and pH tests, unapproved tube placement checking methods, and communication failures resulting in tubes not being checked. The reports included 32 incidents where the patient subsequently died, although given many patients were critically ill before the tube was introduced, it is not always clear whether the death was directly related to the misplaced tube.

Review of local investigations into these incidents suggests problems with organisational processes for implementing previous alerts. This Patient Safety Alert is therefore directed at trust boards (or their equivalent in other providers of NHS funded care) and the processes that support clinical governance. It is NOT directed at frontline staff. Some of the implementation issues identified were:

- problems with systems to ensure staff who were checking tube placement had received competency-based training
- problems with ensuring bedside documentation formats include all safety-critical checks
- problems maintaining safe supplies of equipment, particularly radio-opaque tubes and CE-marked pH test strips.

The resource set that accompanies this alert provides a range of support for trust boards (or their equivalent) to assess whether existing nasogastric tube

Actions

Who: All organisations where nasogastric or orogastric tubes are used for patients receiving NHS-funded care
When: To commence as soon as possible and to be completed by 21 April 2017

1. Identify a named executive director who will take responsibility for the delivery of the actions required in this alert.

2. Using the resources supplied with this alert, undertake a centrally co-ordinated assessment of whether your organisation has robust systems for supporting staff to deliver safety-critical requirements for initial nasogastric and orogastric tube placement checks.

3. If the assessment identifies any concerns, use the resources supplied with this alert to develop and implement an action plan to ensure all safety-critical requirements are met.

4. Share this assessment and agree any related action plan within relevant commissioner assurance meetings.

5. Share the key findings of this assessment and the main actions that have been taken in the form of a public board paper.

* For organisations that are not trusts/foundation trusts and do not have executive directors, a role with equivalent senior responsibility should be identified.
Impact of NG tube misplacement

- 790,000 NG tubes supplied to NHS annually (NHS Supply Chain 2015)
- 1.2-2% of insertions lead to NGT misplacement into airway
- 0.1-0.3% of deaths from misplaced NG tubes due to bronchopulmonary injury
Bronchopulmonary complications

*Increased risks*

- Altered mental state
- Sedation
- Tracheostomy
- Critical illness
- Absent cough reflex
- Multiple tube placements
Thoracic complications

*Bronchial placement*
- Atelectasis
- Pneumonia
- Lung abscess

*Bronchial perforation*
- Pneumothorax
- Enteral feed hydrothorax
- Empyema
- Pulmonary haemorrhage

PnTx - commonest complication (R>L);
Most patients have an uneventful insertion/no resistance felt/etc
Factors contributing to patients being fed via a misplaced tube

1. **Human factors** (e.g. difficulty interpreting X ray)
2. **Equipment factors** (e.g. use of less radiopaque tubes rather than ones that are completely radiopaque)
3. **System factors** (e.g. limited access to out-of-hours specialist radiology help)
4. **Environmental factors** (e.g. workload issues leading to delays)
5. **Communication factors** (e.g. documentation in the notes is often poor - when re-siting tubes it is important to know if there have been previous difficulties placing the tube)
Trust NPSA Responses
Nasogastric (NG) tube guidelines

NG position testing policy

Adult
General Wards (not ICU)

September 2017
**Naso-gastric tube assessment on insertion and ongoing monitoring form**

*N.B. New form required for EACH naso-gastric tube insertion*

**To be used with naso-gastric care plan**

<table>
<thead>
<tr>
<th>Ward / clinical area:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion details</strong></td>
</tr>
<tr>
<td>Informed consent: Yes □ No □</td>
</tr>
<tr>
<td>If No: specify why consent was not obtained:</td>
</tr>
<tr>
<td>Insertion: Date: ________ Time: ________</td>
</tr>
<tr>
<td>Nostil used: Left □ Right □ External tube length:</td>
</tr>
<tr>
<td>Aspirate obtained: Yes □ No □ pH reading if obtained:</td>
</tr>
<tr>
<td>X-ray required: Yes □ No □ X-ray requested: Yes □ No □</td>
</tr>
<tr>
<td>Inserted by - name in full:</td>
</tr>
<tr>
<td>Signature:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X-ray interpretation (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirate obtained by doctor: Yes □ No □ pH reading if obtained:</td>
</tr>
<tr>
<td>Reason for X-ray:</td>
</tr>
<tr>
<td>X-ray: Date: ________ Time: ________</td>
</tr>
<tr>
<td>Position of naso-gastric tube documented:</td>
</tr>
<tr>
<td>Decision to feed: Yes □ No □</td>
</tr>
<tr>
<td>Date: ________ Time: ________ Position confirmation and decision to feed by - name in full:</td>
</tr>
<tr>
<td>Signature:</td>
</tr>
</tbody>
</table>

N.B. The ongoing monitoring checklist should be completed before administration of liquids, artificial nutrition and before administration of medication prescribed via the nasogastric tube.

**Ongoing monitoring**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>pH aspirate obtained</th>
<th>Yes / No</th>
<th>pH reading</th>
<th>External tube length</th>
</tr>
</thead>
</table>

Checked by:  

Please write in boxes Yes or No including a signature, where actions are indicated document in the patient health records.
NG tube

Maintenance of position

• Repeat placement checks
  – Prior to each feed
  – Prior to giving medication
  – Or at least once daily
  – Post vomiting/retching/coughing fits
  – New or unexplained respiratory Sx
  – O2 desaturation
  – Concern about tube displacement
    (loose tape or visible tube appears longer)
CXR Audits

- Were CXR requests pH tested prior to CXR?
- Were misplaced NGT seen on CXR acted upon?
- Are we reducing the numbers of CXR requests in consecutive years?
Training module

• www.trainingngt.co.uk
• e-lfh.org.uk/Component/Details/482786
• More robust documentation - indication for NGT
• Indication for CXR
• How Dr authorised feed to commence
| 4. Staff training, competency frameworks and supervision are reviewed to ensure that all healthcare professionals involved with nasogastric tube position checks have been assessed as competent. Competency training should include theoretical and practical learning. | Clear training and competency frameworks must underpin the theoretical and practical training aspects of all relevant healthcare professionals. | An example eModule training tool for x-ray interpretation of nasogastric tube position is available at: [www.trainingngt.co.uk](http://www.trainingngt.co.uk)

Ensure the following is made available at the appropriate clinical governance forum: a staff training plan / competency framework, supervision and bedside documentation, competencies and standards of supervision as well as a printout of a spreadsheet or database to maintain an active list of staff who are competent in nasogastric tube position checks. |
Avoid OOH CXR requests

• Reduce delay from decision to place NGT to checking position
• Can senior nurses request CXR after failed pH if junior Dr tied up with sth else
• Radiographers to challenge requests for CXR
• How to enhance portering to get pt to x-ray ASAP
• Minimise use of portable CXR
Nasogastric tubes: x-ray interpretation aid

- Is nasogastric tube feeding the right decision for this patient?
- Is this the right time to place the nasogastric tube and is the appropriate equipment available?
- Is there sufficient knowledge/expertise available at this time to test for safe placement of the nasogastric tube?

To confirm gastric position of the nasogastric tube, ask:

- Does the tube path follow the oesophagus/avoid the contours of the bronchi?
- Does the tube clearly bisect the carina or the bronchi?
- Does it cross the diaphragm in the midline?
- Is the tip clearly visible below the left hemi-diaphragm?

Proceed to feed only if all criteria are met. If in any doubt repeat x-ray or call for senior help.
1. *Is NG feeding right for this patient?* The decision to feed should be agreed by two competent professionals and recorded.

2. *Does the NG tube insertion need to be done now?* Risks are greater during the night.

3. *Am I competent to do this?* Ensure you have had training in safe insertion and checking.

4. *How can I check the right amount of tube has been inserted?* Use “NEX” measurement to guide insertion. The tube length should be confirmed and recorded before each feed to check it has not moved.
5. Do I know how to test for correct placement? Confirm by testing with quantitative pH indicator paper. Some reports suggest staff believe it is acceptable to insert water or other fluid to ‘flush out some aspirate’. This is never safe to do.

6. What is a safe pH level? pH levels between 1 and 5.5 are safe. Double-check with another person if you are unsure. Always record the result and the decision to start feeding.

7. When should I get an x-ray? If no aspirate can be obtained or the pH reading is above 5.5, request an x-ray specifying the purpose so the radiographer knows the tip of the NG tube should be visible.
NO

Red litmus paper with a drop of base here

Blue litmus paper with a drop of acid here