

# Patient safety alert



## Alert

18 August 2005

Immediate action	<input checked="" type="checkbox"/>
Action	<input type="checkbox"/>
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Information request	<input type="checkbox"/>

### Reducing the harm caused by misplaced naso and orogastric feeding tubes in babies under the care of neonatal units

Gastric tube feeding, both naso and orogastric, is used extensively in neonatal units. Thousands of tubes are inserted daily without incident. However, there is a small risk that the tube can become misplaced into the lungs during insertion, or move out of the stomach at a later stage. Studies have shown that testing methods to check the placement of nasogastric feeding tubes in adults and children can be inaccurate.<sup>1-5</sup> A recent alert (NPSA Patient Safety Alert 05) issued advice on which methods should and should not be used in adults and children.

This is additional advice that is specific to neonates as they differ physiologically from adults and children in terms of gastric pH. The British Association of Perinatal Medicine has worked with the NPSA on developing this advice, and the Neonatal Nurses Association and the Royal College of Paediatrics and Child Health have also agreed it.

#### 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. Give staff, and carers of babies in the community, the following information on correct and incorrect testing methods (see [www.npsa.nhs.uk/advice](http://www.npsa.nhs.uk/advice)). We recommend:
  - neonatal units and carers change to using pH indicator strips or paper, following competency based training and education, by 1 January 2006;
  - radiography should NOT be used 'routinely' but can be used if the baby is being x-rayed for another reason. Tubes with markings should be used for all babies to enable accurate measurement of depth and length and the position of the tube documented;
  - DO NOT use the auscultation method ('whoosh' test) to determine tube position;
  - DO NOT interpret the absence of respiratory distress as an indicator of correct positioning;
  - DO NOT test correct positioning by monitoring for bubbling at the end of the tube;
  - DO NOT use the appearance of feeding tube aspirate as a primary method to rule out misplacement.
2. Carry out individual risk assessment prior to gastric tube feeding.
3. Review and agree local action required.

#### For response by:

- NHS acute trusts (including foundation trusts), primary care organisations and local health boards in England and Wales

#### For action by:

- Directors of Nursing in England and Wales

#### We recommend you also inform:

- Neonatal nursing staff (including community nurses)
- Midwives
- Neonatologists
- Paediatricians
- Medical staff (including radiologists)

- Medical directors
- Clinical governance leads and risk managers
- Nutritional nurse specialists
- Speech and language therapists, physiotherapists, dieticians
- Chief pharmacists/pharmaceutical advisers
- Patient advice/liason service staff in England
- Procurement managers

#### The NPSA has informed:

- Chief executives of acute trusts, primary care organisations and local health boards in England and Wales
- Chief executives/regional directors and clinical

governance leads of strategic health authorities

- (England) and regional offices (Wales)
- Healthcare Commission
- Healthcare Inspectorate Wales
- NHS Purchasing and Supply Agency
- Welsh Health Supplies
- Royal Colleges and societies
- NHS Direct
- Relevant patient organisations and community health councils in Wales
- Independent Healthcare Forum
- Commission for Social Care Inspection
- Quality Improvement Scotland and DHSSPS, Northern Ireland

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### Action deadlines for the Safety Alert Broadcast System (SABS)

#### Deadline (action underway): 1 September 2005

Action plan to be agreed and actions started

#### Deadline (action complete): 1 January 2006

All actions to be completed

Further information about SABS can be found at

[www.info.doh.gov.uk/sar/cmopatie.nsf](http://www.info.doh.gov.uk/sar/cmopatie.nsf)

### Further information on the action points

#### 1 Provide staff, and carers of babies in the community, with information on correct and incorrect testing methods

Staff should be informed that none of the existing methods for testing the position of gastric (naso and orogastric) feeding tubes are totally reliable. This advice is based on the premise that it is better to base clinical decisions on one, reliable test (pH indicator strips/paper or radiography), than on a combination of tests with varying reliability.

A copy of this alert should be given to relevant staff. Information for carers of babies in the community can be found at [www.npsa.nhs.uk/advice](http://www.npsa.nhs.uk/advice)

#### The following methods MUST NOT be used:

##### Auscultation of air insufflated through the feeding tube ('whoosh' test)

There are many reports on the ineffectiveness of this method.<sup>1,3,4</sup> In several cases, results indicated correct tube placement but feeding was started with disastrous results.<sup>3</sup> The auscultation method requires staff to distinguish between air passed through the tube via the oesophagus into the stomach, and air passed via the main bronchus into the lungs; a position not anatomically far from the stomach. There is no evidence to suggest that it is easier or more reliable to differentiate between oesophageal and bronchial insertion in neonates. Experts have repeatedly highlighted the difficulties in using this method.<sup>6</sup>

##### Testing acidity/alkalinity of aspirate using blue litmus paper

Universal pH testing paper or strips are recommended for testing the acidity/alkalinity of aspirate, rather than litmus paper.<sup>7</sup> The Medicines and Healthcare products Regulatory Agency (MHRA) distributed this advice to all NHS staff in June 2004. Blue litmus paper is not sensitive enough to distinguish between bronchial and gastric secretions.<sup>8</sup>

##### Interpreting absence of respiratory distress as an indicator of correct positioning

Observing for signs of respiratory distress is ineffective in detecting a misplaced tube.<sup>9,10</sup> Small bore tubes can enter the respiratory tract with few, if any, symptoms<sup>10</sup> and large bore tubes can enter a patient's respiratory tract without any symptoms being shown, particularly if the patient is unconscious.<sup>9</sup>

##### Monitoring bubbling at the end of the tube

Looking for bubbling at the proximal end of the tube is unreliable because the stomach also contains air and could falsely indicate gastric placement.<sup>3</sup>

##### Observing the appearance of feeding tube aspirate

Research and anecdotal evidence indicate that relying on the appearance of feeding tube aspirate is unreliable as a primary testing method as gastric contents can look similar to respiratory secretions.<sup>11</sup>

## How to confirm the correct position of naso and orogastric feeding tubes in babies under the care of neonatal units

Gastric tube feeding, both naso and orogastric, is used extensively in neonatal units. Thousands of these tubes are inserted daily without incident. However, there is a small risk that the tube can become misplaced into the lungs during insertion, or move out of the stomach at a later stage. Studies have shown that testing methods to check the placement of nasogastric feeding tubes in adults and children can be inaccurate.<sup>1-5</sup>

The following advice informs staff about which methods should and should not be used to check the position of gastric feeding tubes in neonates. The British Association of Perinatal Medicine has worked with the NPSA on developing this advice, and the Neonatal Nurses Association and the Royal College of Paediatrics and Child Health have also agreed it.

Traditionally, in neonatal units, litmus paper has been used to check the position of the nasogastric tube. However, recent alerts (MHRA /2004/026 and NPSA Patient Safety Alert 05) have recommended the use of pH indicator strips or paper<sup>8</sup> rather than blue litmus. There is no evidence that use of litmus paper has resulted in harm in neonates, although it may be that serious incidents have been under reported. Further research is being commissioned to develop an evidence base for neonatal pH values. In the interim it is recommended that neonatal units' guidelines for testing the position of tubes do not fall below the standards set out in this document.

### Testing the position of gastric feeding tubes

#### We recommend only the following tests for gastric tube placements:

- neonatal units and carers of babies in the community change to using pH indicator strips or paper following competency based training and education by 1 January 2006;
- radiography should NOT be used 'routinely' but can be used if the baby is being x-rayed for another reason. Tubes with markings to enable accurate measurement of depth and length should be used.

### The limitations of pH testing and radiography

There are many factors in neonates that affect the results from pH indicator strips or paper<sup>8,17</sup> including:

- gestation;
- postnatal age;
- small volumes of aspirate;
- medications that affect the gastric pH;
- continuous and frequent feeding.

Additionally, gaining aspirate from the feeding tube can be difficult, particularly when using fine bore tubes.

The most accurate method for confirming correct tube placement is radiography. However, x-ray for the sole purpose of confirming gastric tube position in a neonate is not recommended. Minimising the number of x-ray exposures avoids unnecessary exposure to radiation, loss of feeding time and increased handling of small babies. If it is possible, a baby that is going to have an x-ray as part of their care management, should have the gastric tube in place beforehand. Tube position can then be checked at the same time as the x-ray.

### Risk Assessment

Staff should consider the factors for each patient that may contribute to a high gastric pH (pH 6 or above). Possible factors include:

- the presence of amniotic fluid in a baby under 48 hours old;<sup>10,12</sup>
- milk in the baby's stomach, particularly if they are on one to two hourly feeds;<sup>11</sup>

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- use of medication to reduce stomach acid.<sup>12</sup>

Even though aspirates testing pH 5.5 and below should indicate correct placement in most babies, including the majority of those receiving acid suppressants, some babies will consistently have pH values of 6 and above.

It is important that staff work through the flowchart in this document and record their findings prior to making any decisions. The multidisciplinary care team should then discuss possible actions to take, and again record how they reached their decision. These must be based on balancing the risks between not feeding a baby, in the short term, with feeding when there is the possibility of the tube being in the lungs.

### Recommended pH levels and what pH paper and strips should be used

We recommend that the cut-off level for feeding to commence should be pH 5.5 or below. Senior advice should be sought if pH values are 6 or above. Indicator strips or paper should be used that have:

- a range from 0 to 6 or 1 to 11;
- a resulting colour change that is easily distinguishable, particularly between the pH 5 and 6 range;
- colour change within 10 to 15 seconds.

For recommended products go to: [www.pasa.nhs.uk/medsurg/shared/medicaldiagnostics/lab\\_cons.stm](http://www.pasa.nhs.uk/medsurg/shared/medicaldiagnostics/lab_cons.stm)

NHS organisations should choose a product suitable for their purposes and make sure that only one type is available on the neonatal unit at any one time. This will reduce the risk of misinterpreting the colour changes through using different brands.

### When to check the tube position

The tube position should be checked:

- following initial insertion;
- before administering each feed;
- before giving medication;
- following vomiting, retching or coughing. However, the absence of coughing does not rule out misplacement or migration;
- if there is evidence of tube displacement. For example, if the tape is loose or the visible tube appears longer or kinked.

If the baby is on continuous feeds, tube checking should be synchronised with the syringe changes. When continuous feeding has stopped, wait 15 to 30 minutes to allow the stomach to empty of milk and the pH level to fall.

### Reporting misplaced tube incidents

NHS organisations should ensure that all staff report misplaced feeding tube incidents through their local risk management systems. The NPSA will automatically receive this information through the National Reporting and Learning System (NRLS). This will enable both local and national monitoring of gastric feeding tube misplacements and inform our understanding of the problem.

### Flowcharts and additional information

The flowcharts and rationale on the next two pages set out clinical advice on how to obtain sufficient aspirate and what to do when the pH level is 6 or above.

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## The recommended procedure for checking the position of the naso and orogastric feeding tube in babies under the care of neonatal units

Use this flowchart as a basis for decision making

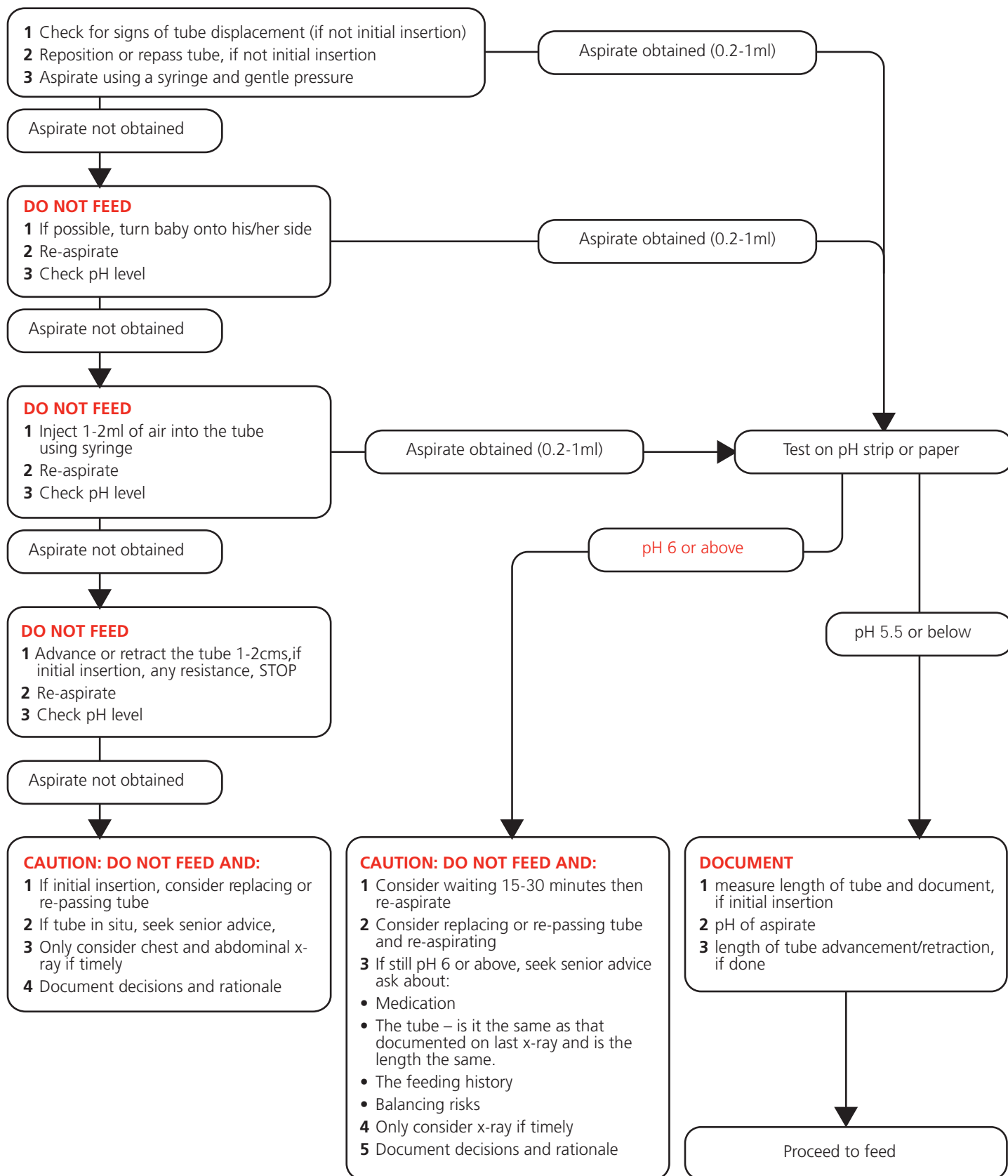
Action	Rationale
Check for signs of tube displacement (if not initial insertion)	The tube may have coiled up in the mouth or if there is more tube visible than previously documented, the tube may have kinked. Loose tape may indicate movement. If tube has been displaced, it will need repositioning or re-passing before feeding.
Aspirate 0.2–1ml gastric fluid and allow ten to 15 seconds for any colour change	0.2 to 1ml of aspirate will cover an adequate area on single, double or triple reagent panels of pH testing strips or paper.
Aspirate using a syringe	It is safe practice to use gastric tubes and enteral syringes that have non luer lock connectors ( <i>Building a Safer NHS for Patients: Improving Medication Safety</i> published 22/01/2004 available at <a href="http://www.dh.gov.uk">www.dh.gov.uk</a> ).
Aspirate is pH 5.5 or below <b>PROCEED TO FEED</b>	Aspirates testing pH 5.5 and below should indicate correct placement in most babies (including the majority of those receiving acid suppressants) and rule out the possibility of respiratory tract placement. <sup>13</sup> Always match the pH indicator strip or paper colour change with the colour code chart on the booklet or box. If there is ANY doubt about the position and/or clarity of the colour change on the pH indicator strip or paper, particularly between pH5 and 6, DO NOT commence feeding.
Aspirate is pH6 or above <b>CAUTION – STOP FEED:</b> if clinically safe, consider waiting 15–30 minutes before aspirating again. Consider replacing and/or re-passing the tube and re-aspirating  If still pH 6 or above, seek advice  <b>IT IS IMPORTANT THAT STAFF FOLLOW THE FLOWCHART, RECORD THE OUTCOMES AND MAKE DECISIONS BASED ON THIS INFORMATION</b>	The most likely reason for failure to obtain gastric aspirate pH 5.5 or below is the dilution of gastric acid by enteral feed. Waiting gives time for the stomach to empty and the pH value to fall. If pH is still 6 and above after waiting and replacing or re-passing the tube, seek advice and consider the following questions: <ul style="list-style-type: none"> <li>• is the baby on medication?</li> <li>• is the baby only 24 to 48 hours old?</li> <li>• is the tube in the same position as previously documented on an x-ray?</li> <li>• Is the visible length of the tube the same as previously documented?</li> <li>• what is the trend in pH values?</li> <li>• what is the volume of aspirate?</li> </ul> It is important that actions and their rationale are documented. Clinical staff should balance the risks of not feeding a baby, in the short term, with feeding when there is the possibility of the tube being in the lungs. Only consider x-ray if timely, e.g. if the baby is due for an x-ray for other reasons, and/or it is clinically safe to do so. If an x-ray is done, the radiographer should know this advice has been followed and the reason for the request should be documented.
Document all information	Documenting helps the clinical decision-making process. The tube size and length should be recorded each time the tube is passed. A record should also be made each time measurements of the pH level of the aspirate and the length of the tube's advancement or retraction, are done.
Problems obtaining aspirate: suggest using larger size tubes with multiple ports. Turn baby onto his/her side	This may facilitate the tip of the nasogastric tube entering the gastric fluid pool.
Inject 1–2ml of air using a syringe <b>This is NOT a testing procedure</b>	Injecting air through the tube may dislodge the exit-port of the feeding tube from the gastric mucosa. Care must be taken when using large syringes on neonates to ensure that the correct amount of air is inserted, i.e., no more than 2ml.
Advance or retract the tube by 1–2cm Stop if there is any resistance or obstruction	If the tube is in the oesophagus, advancing it may allow it to pass into the stomach. If the tube has been inserted too far, it may be in the duodenum. Consider withdrawing a few centimetres and re-aspirating. The position of the tube at the nose should already have been recorded and marked, if the tube is in situ. If the mark has not moved then advancing or retracting may not make a difference. Document the length of tube if moved.
If you still cannot obtain aspirate	If this is an initial insertion then consider replacing or re-passing the tube. If the tube has been in situ already, seek advice. Consider whether the length of the tube has changed and discuss options as outlined under the action point on aspirate of pH 6 and above. Record all decisions and their rationale.

For more information about the safety issues involved please see [www.npsa.nhs.uk/advice](http://www.npsa.nhs.uk/advice)

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**CAUTION:** If there is ANY query about position and/or the clarity of the colour change on the pH strip, particularly between ranges 5 to 6, then feeding should not commence.



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## 2 Carry out an individual risk assessment prior to gastric tube feeding

Staff should consider factors for each patient that may contribute to high gastric pH (pH 6 or above). Factors that should be considered in neonates include:

- the volume of gastric fluid is very small and may lead to difficulties in obtaining aspirate;
- amniotic fluid in a baby under 48 hours old<sup>12,13</sup> and a reduced ability to produce gastric hydrochloric acid (relative achlorhydria) may produce increased pH values (pH 6 or above);
- babies fed every one to two hours<sup>14</sup>, and those on medication to reduce stomach acid<sup>15</sup>, may also have raised pH values;

Even though aspirates testing pH 5.5 and below should indicate correct placement in most babies, including the majority of those receiving acid suppressants, some babies will consistently have pH values of 6 and above.

It is important that staff work through the flowchart in this document and record their findings prior to making any decisions. The multidisciplinary care team should then discuss possible actions to take, and record how they reached their decision. These must be based on balancing the risks between not feeding a baby, in the short term, with feeding when there is the possibility of the tube being in the lungs.

## 3 Review and agree local action required

Changing and improving clinical practice in relation to gastric feeding tube placement will require a local programme to facilitate change.<sup>16</sup> NHS organisations need to ensure that:

- pH indicator testing strips and paper are stocked in all relevant clinical areas, and are available to carers in the community;
- staff and carers are trained, on a competency framework basis, in the placement and testing of gastric feeding tubes and on how to risk-assess this procedure;
- radiographs taken to confirm the position of the tube are interpreted by appropriately trained clinical staff;
- radio-opaque tubes with markings to enable accurate measurement and identification are used, and the position of the tube is documented in the baby's notes.

## 4 Report misplacement incidents via their local risk management reporting systems

NHS organisations should ensure that all staff report misplaced feeding tube incidents through their local risk management systems. The NPSA will automatically receive this information through the National Reporting and Learning System (NRLS). This will enable both local and national monitoring of gastric feeding tube misplacements and inform our understanding of the problem.

## Next steps

### Different testing methods

The Patient Safety Research Programme at the University of Birmingham has commissioned work to further assess existing testing methods and will include specific work on neonates. This may mean that some of the advice in this alert will be revised at a later date.

### Working with other organisations

The NPSA will work with industry on an investigation into the feasibility of having pH values of feeds displayed on all enteral feed packaging. The NPSA will work with the MHRA and industry to identify and rectify any further contributing factors. The NPSA will also work with the editors of the Royal Marsden Manual of Clinical Procedures to ensure that their guidance reflects the information contained in this alert.

### NPSA review of actions implemented

In January 2006, the NPSA will review how the action points in this alert have been implemented through the Safety Alert Broadcast System in England. Alternative arrangements will be made for Wales. Where actions have not been implemented, the NPSA will expect the relevant strategic health authority or regional office to provide a full explanation.

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### Contacts

For further details about this patient safety alert, please contact Dr Patricia Bain, Patient Safety Manager, at [patricia.bain@npsa.nhs.uk](mailto:patricia.bain@npsa.nhs.uk) or your local Patient Safety Manager.

For further information about the NPSA's work on gastric feeding tubes, please contact:

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### References

- 1 Hendry PJ et al. Bronchopleural complications of nasogastric feeding tubes. *Crit Care Med* 1986; 14(10): 892–4.
- 2 Hand RW et al. Inadvertent transbronchial insertion of narrow-bore feeding tubes into the pleural space. *JAMA* 1984; 251(18): 2396–7.
- 3 Metheny NA, Aud MA. Detection of improperly positioned feeding tubes. *J Health Risk Manag* 1998; 18(3): 37–48.
4. Eel-Gamel A, Watson DC. Transbronchial intubation of the right pleural space: a rare complication of nasogastric tube intubation with a poly-vinylchloride tube – a case study. *J Acute Critical Care* 1993; 22(3): 224–5.
- 5 Dobranowski J et al. Incorrect positioning of nasogastric feeding tubes and the development of pneumothorax. *Canadian Association of Radiologists Journal* 1992; 43(1): 35–9.
6. Bankier AA et al. Radiographic detection of intrabronchial malpositions of nasogastric tubes and subsequent complications in intensive care unit patients. *Intensive Care Med* 1997; 23(4): 406–10.
7. Rollins H. A nose for trouble. *Nursing Times* 1997; 93(49): 66.
- 8 MHRA Notice MHRS/MS/2004/026.
- 9 Rassias AJ et al. A prospective study of tracheopulmonary complications associated with the placement of narrowbore enteral feeding tubes. *Critical Care* 1998; 2(1): 25–8.
- 10 Metheny N et al. Detection of inadvertent respiratory placement of small-bore feeding tubes: a report of 10 cases. *Heart Lung J Acute Crit Care* 1990; 19(6): 631–8.
- 11 Theodore AC et al. Errant placement of nasoenteric tubes. A hazard in obtunded patients. *CHEST* 1984; 86(6): 931–3.
12. Widstrom AM et al. Gastric aspirates of newborn infants: pH, volume and levels of gastrin-Somatostatin-Like Immunoreactivity. *Acta Paediatrics Scand* 1998; 77: 502–8.
- 13 Kelly EJ et al. Gastric acid secretion in preterm infants. *Early Human Development* 1993; 35(3): 215–20.
- 14 Washington N et al. Dual pH probe monitoring versus single pH probe monitoring in infants and milk feeds: the impact on diagnosis. *Archives of Disease in Childhood* 1999; 81(4): 309–12.
- 15 Kuusala A-L. Long term gastric pH monitoring for determining optimal dose of ranitidine for critically ill preterm neonates. *Archives of Diseases in Childhood Fetal and Neonatal* 1998; 78(2): F151–3.
- 16 Huffman S et al. Methods for confirming feeding tube placement: Application of research in practice. *Pediatr Nurs* 2004; 30(1): 10.
- 17 Metheny NA et al. Indicators of feeding tube placement in neonates. *Nutrition in Clinical Practice* 1999; 14: 307–14.
- 18 Soundheimer JM et al. Continuous gastric pH measurement in young and older preterm infants receiving formula and clear liquid feedings. *Journal of Paediatric Gastroenterology and Nutrition* 1985; 4: 352–5.
- 19 Metheny et al. pH testing of feeding tube aspirates to determine placement. *Nutr Clin Pract* 1994; 9(5): 185–90.



A patient safety alert requires prompt action to address high risk safety problems.

This patient safety alert is written in the following context:

It represents the view of the National Patient Safety Agency, which was arrived at after consideration of the evidence available. It is anticipated that healthcare staff will take it into account when designing services and delivering patient care. This does not, however, override the individual responsibility of healthcare staff to make decisions appropriate to local circumstances and the needs of patients and to take appropriate professional advice where necessary.

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