

GUIDELINE FOR THE USE OF ORO/NASOGASTRIC TUBES ON THE NEONATAL UNIT

Background

Gastric tube feeding, both oro and nasogastric, is used extensively in neonatal units and thousands of tubes are inserted daily without incident (NPSA 2005). 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 (NPSA 2005). Misplaced nasogastric tubes represent a potentially serious risk, with complications including delays to feeds and medication, aspiration, pneumothorax, gastric perforation, pneumonia and death (NHS Improvement 2016; Taylor *et al* 2014).

The NHS Improvement Patient Safety Alert (NHSI 2016), aimed at Trust Boards, highlights that patient safety risks related to nasogastric tube placement persist, despite three previous national safety alerts. Errors involving nursing staff and pH testing, unapproved tube placement checking methods and communication failures resulting in tubes not being checked contributed to 95 incidents investigated between 2011 and 2016 (NHSI 2016). NHS Improvement (2016) suggest that checking tube placement before use via pH testing of aspirate and, when necessary, x-ray imaging, is essential in preventing harm.

Rationale

Oro/nasogastric tubes are frequently indicated for premature and sick infants on the neonatal unit, for a variety of reasons, including:

- an inability to take feeds orally;
- gastric decompression;
- the administration of medication;
- the absence of a gag reflex;
- congenital anomalies;
- prematurity;
- poor coordination of sucking and swallowing;
- paralysis as a result of medication.

Practice

Insertion of oro/nasogastric tubes

- Inform parents, if present;
- Gather all equipment, including an enteral syringe; CE marked pH strips; gloves; a dressing to secure the tube and an appropriately sized feeding tube. A larger tube may be required to facilitate gastric decompression in surgical infants or those on CPAP;
- Place the infant in a comfortable position. Consider the use of containment/still holding, swaddling and/or non-nutritive sucking to minimise stress for the infant;
- **Calculate the desired length of the gastric tube by measuring the distance from the nose (or mouth for orogastric tubes) to the ear and then to the mid-point between the xiphoid process and the umbilicus. The xiphoid process is at the base of the sternum and this measurement is known as the NEMU measurement**
- Check this length by using the following weight-based calculation and insert the tube to the greatest length obtained with either of the techniques. The weight-based calculation and a table of values for different weights is shown on page 3;
- Wear gloves and advance the tube gently but quickly via the mouth or nostril into the oesophagus until you reach the desired length, pausing if you meet resistance;
- If any resistance is felt, attempt to pass the oro/nasogastric tube via the other nostril. Do not apply excessive force and inform medical staff if you are still unable to pass the feeding tube;
- Hold or secure the tube while you verify the position of the tube by connecting an enteral syringe to obtain gastric aspirate and check the gastric pH (see section below on 'verifying position of oro/nasogastric tubes' for more information about acceptable pH values);
- If you are unable to pass the oro/nasogastric tube to the desired length, despite trying both nostrils, this may be due to a structural anomaly e.g. choanal atresia or oesophageal atresia. For diagnostic purposes, it can be helpful to leave the oro/nasogastric tube in place for an x-ray. In this instance, consult with the medical team to check whether the tube should be left in situ;
- If no gastric aspirate is obtained at all, perform the steps outlined in the flow chart in Appendix B, including:
 - turn the infant onto their side and re-aspirate;

- instill 1-2ml of air into the tube with an enteral syringe, in an attempt to move the tip of the tube away from the gastric mucosa and into the gastric pool and re-aspirate. This is NOT a testing procedure but a method of trying to obtain an aspirate. It is important to note that auscultation while the air is instilled, sometimes known as the “whoosh test”, is NOT an acceptable method of verifying the tube position;
- advance/withdraw the tube by 1-2cm and re-aspirate;
- re-site tube and re-aspirate;
- if the baby is able to safely take a small volume of milk orally, consider this and then re-aspirate;
- consider an x-ray to confirm position, if this is planned for another reason or it is deemed safe to do so. The length of the oro/nasogastric tube may require subsequent adjustment depending on its position on x-ray

ORO/NASOGASTRIC TUBE LENGTH ACCORDING TO WEIGHT-BASED CALCULATION		
NGT length = [3 x weight (kg)] + 13cm for NGT or OGT length = [3 x weight (kg)] + 12cm for OGT		
WEIGHT RANGE (kg)	NGT LENGTH	OGT LENGTH
<500g	14cm	13cm
0.501kg to 0.8kg	15cm	14cm
0.801kg to 1.1kg	16cm	15cm
1.101kg to 1.5kg	17cm	16cm
1.501kg to 1.8kg	18cm	17cm
1.801kg to 2.1kg	19cm	18cm
2.101kg to 2.5kg	20cm	19cm
2.501kg to 2.8kg	21cm	20cm
2.801kg to 3.1kg	22cm	21cm
3.101 to 3.5kg	23cm	22cm
3.501kg to 3.8kg	24cm	23cm
3.801kg to 4.1kg	25cm	24cm
4.101kg to 4.5kg	26cm	25cm
4.501kg to 4.8kg	27cm	26cm
4.801kg to 5.1kg	28cm	27cm
5.101kg to 5.5kg	29cm	28cm

Verifying position of oro/nasogastric tubes

A National Patient Safety Agency (NPSA) alert called '*Reducing the harm caused by misplaced naso and orogastric tubes in babies under the care of neonatal units*' (2005) provides additional guidance that is specific to neonates, as they differ physiologically from adults and children, in terms of gastric pH. For example, it is often impractical and unsafe to wait for a period of time, without feeding, to see if the neonatal gastric pH becomes more acidic, as is advised as a potential option for adults. In addition, gaining aspirate from fine bore feeding tubes can be difficult. The British Association of Perinatal Medicine has worked with the NPSA on developing this advice and it has been agreed by the Neonatal Nurses Association and the Royal College of Paediatrics and Child Health.

Although a subsequent National Patient Safety Agency alert (NPSA 2011) was designed to update and strengthen the NPSA (2005) guidance, in relation to the checking and confirmation of correct nasogastric tube position, this document states that '*it does not replace the 2005 guidance Reducing the harm caused by misplaced naso and orogastric feeding tubes in babies under the care of neonatal units*'.

This 2005 guidance highlights several factors that will affect the pH of neonatal gastric aspirates, which includes:

- the frequency of feeding, as babies on a neonatal unit may be fed continuously or frequently (1-2 hourly);
- the small volumes of gastric aspirate;
- the administration of medications, including those for reflux, which may neutralise the pH
- the presence of amniotic fluid in the stomach, especially if the baby is <48 hours old
- the gestation at birth and the postnatal age, as the newborn gastric pH is generally more neutral than in later life, particularly in premature babies and up to around day 10 of life.
- **This NPSA alert (2005) states that “*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.*” A gastric pH of 5.5 is the recommended cut off to proceed to feeding without further action but a gastric pH of 6 may also be acceptable, following a balance of risks and discussion with senior staff. The most likely reason for failing to obtain a**

gastric pH of 5.5 or less is the dilution of gastric acid. However, in this instance staff must consider and document the actions outlined in the flow chart in Appendix B, including:

- advance or withdraw the tube by 1-2 cm and re-aspirate;
- re-site the tube and re-aspirate.

If, following this, the gastric pH remains >5.5, discuss with senior medical staff and consider the following:

- feeding frequency;
- medication;
- age of the baby (are they <48 hours old);
- tube length (is this the same length as documented previously, has the length changed from when the last x-ray was taken/tube position was checked?);
- an x-ray if one is due for other reasons and/or it is clinically safe to do so.

Although its application has not been validated in neonates, ultrasound may be a potentially helpful adjunct to evaluate tube placement, providing a member of the senior medical team feels competent and confident to do so. All actions, decisions and rationale must be documented if a pH of 6 or above is obtained.

Ongoing safety of oro/nasogastric tubes

- Competency-based training must be completed by all nursing staff involved with position checks for oro/nasogastric tubes. Nurses undertaking the neonatal qualification in specialty are required to complete a competency relating to nutrition in order to pass the course. This includes an assessment of oro/nasogastric tube feeding, although these documents are held by the staff member. A separate competency relating to the insertion and ongoing management of oro/nasogastric tubes is held locally on the neonatal unit;
- Gastric pH and the external tube length must be checked following insertion of an oro/nasogastric tube and prior to the administration of feeds/medication or if any movement of the tube is suspected e.g. following a vomit, insecure fixation method;
- An insertion bundle must be completed for each new oro/nasogastric tube, documenting the size and length of the tube, as well as the date and time of insertion;
- An ongoing care bundle must be completed every shift for each oro/nasogastric tube;

- The gastric pH and external tube length must be documented each time a feed is administered;
- Air should be aspirated from the gastric tube every 2 hours when an infant is receiving nasal CPAP with flow rates of >5lpm and this volume should be documented on the feed chart;
- Oro/nasogastric tubes must be replaced in accordance with the manufacturer's recommended guidance;
- Following surgery, any misplaced trans-anastomotic tubes (TATs) must not be re-sited without agreement from a surgeon/Neonatal Consultant;
- Infants must not be left unattended during gravity tube feeds;
- A patient identifier label with the date of insertion must be affixed to each oro/nasogastric tube to allow maternal breast milk administration checks to be performed;
- Ensure that oro/nasogastric tubes are well-secured and that incubator/cot covers are not entirely obscuring the infant during the administration of enteral pump feeds;
- On completion of feeds, enteral syringes should be removed and the feeding tube closed, unless the infant is receiving nasal CPAP. In this instance, a clean/dry syringe must be connected to the tube to facilitate the escape of air from the stomach;
- The volume and colour of gastric aspirates must be documented as this may highlight feeding intolerance. Other signs may include vomiting and abdominal distension.

References

- Cirgin Ellett, M.L., M.D. Cohen, S.M. Perkins, C.E. Smith, K.A. Lane and J.K. Austin. 2011. Predicting the insertion length for gastric tube placement in neonates. *Journal of Obstetrics, Gynaecologic and Neonatal Nursing* 40(4): 412-421.
- Dias, F.S.B., S.C.D. Emidio, M.H.B.M. Lopes, A.K.K. Shimo, A.R.M. Beck and E.V. Carmona. 2017. Procedures for measuring and verifying gastric tube placement in newborns: an integrative review. *Latino-Am. Enfermagem* 25: e2908. Available at: <http://dx.doi.org/10.1590/1518-8345.1841.2908>
- Nguyen, S., A. Fang, V. Saxton and J. Holberton. 2016. Accuracy of a weight-based formula for neonatal gastric tube insertion length. *Advances in Neonatal Care* 16(2): 158-161.
- National Patient Safety Agency (NPSA). 2005. *Reducing the harm caused by misplaced naso and orogastric tubes in babies under the care of neonatal units*. Available at: <https://webarchive.nationalarchives.gov.uk/20090706060315/http://www.npsa.nhs.uk/nrls/alerts-and-directives/alerts/feedingtubes/>
- National Patient Safety Agency (NPSA). 2011. *Reducing the harm caused by misplaced nasogastric feeding tubes in adults, children and infants*. Available at: <https://webarchive.nationalarchives.gov.uk/20170906195638/http://www.nrls.npsa.nhs.uk/resources/clinical-specialty/radiology-and-radiotherapy/?entryid45=129640&cord=DESC&p=1>
- NHS Improvement (NHSI). 2016. *Patient Safety Alert: Nasogastric tube misplacement: continuing risk of death and severe harm*. Available at: https://improvement.nhs.uk/documents/194/Patient_Safety_Alert_Stage_2_-_NG_tube_resource_set.pdf
- Taylor, S.J., K. Allan, H. McWilliam and D. Toher. 2014. Nasogastric tube depth: the “NEX” guideline is incorrect. *British Journal of Nursing* 23(12): 641-644.
- Tsujimoto, H., Y. Tsujimoto, Y. Nakata, M. Akazawa and Y. Kataoka. 2017. Ultrasonography for confirmation of gastric tube placement. *Cochrane Database of Systematic Reviews* Issue 4. Art No CD 012083.

APPENDIX A: Methods to estimate oro/nasogastric tube length

A number of methods exist to estimate the correct length of oro/nasogastric tubes. This appendix summarises some of the issues associated with each of these methods.

1. The 'NEX' (nose to ear to xiphisternum) measurement

The NEX measurement is reported to be only 55-61% accurate (Cirgin Ellett *et al* 2011; Nguyen *et al* 2016 and Taylor *et al* 2014) and use of this method is likely to increase the risk of positioning the tube tip above the gastro-oesophageal junction (Dias *et al* 2017).

2. Age-related height-based formulae

A 2011 study of 173 infants (Cirgin Ellett *et al* 2011) found that the original age-related height-based formula was only 78% accurate. As length is not measured as frequently as weight in neonatal settings, an age-related height-based formula may not be as practical as one that is based on weight.

3. Ultrasonography

Larger studies are needed to determine the value of ultrasound to confirm neonatal gastric tube placement but it may be useful in detecting misplaced tubes where x-ray is not readily available (Tsujimoto *et al* 2017). In adults, ultrasound has been shown to have high sensitivity and specificity for gastric tube placement but it has not yet been validated in neonates. It may be an appropriate adjunct for evaluating tube placement when senior medical personnel feel confident and competent to do so.

4. The 'NEMU' (nose to ear to mid-umbilicus) measurement

This method involves measuring from the nose to the ear to a point midway between the xiphoid process and the umbilicus and has been estimated to be 91% accurate (Cirgin Ellett *et al* 2011). The integrative review by Dias *et al* (2017) supports the use of the NEMU measurement claiming it is the best evidenced method of determining gastric tube length to date. Both Dias *et al* (2017) and Nguyen *et al* (2016) advocate that the use of a weight-

based formula as a check to the NEMU measurement is likely to increase the chance of correctly siting gastric tubes.

5. Weight-based formulae

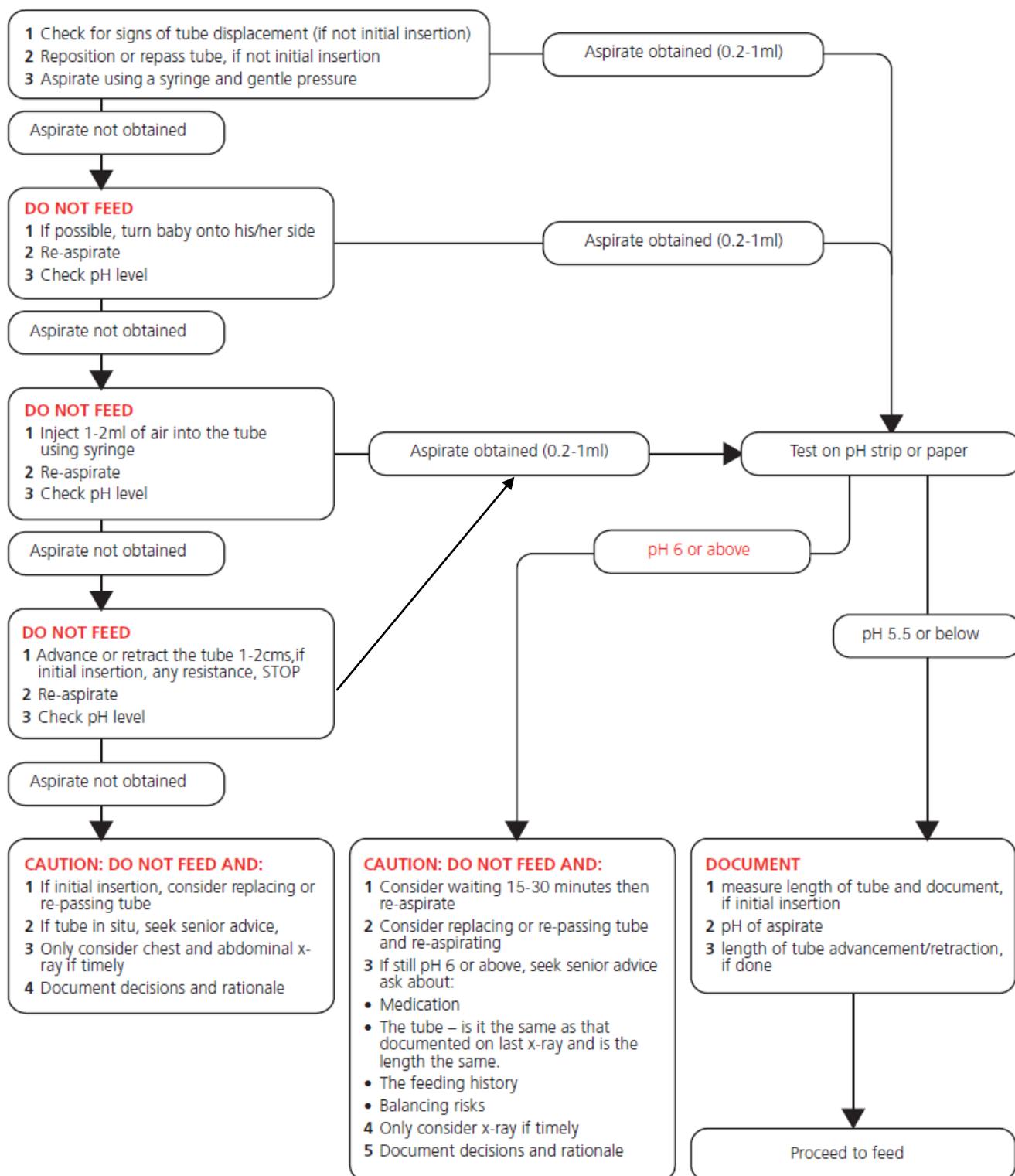
Weight is a growth parameter that is regularly measured in neonatal units and is an objective parameter which may offer a useful way to check the measurements obtained using the NEMU method. Nguyen *et al* (2016) and Dias *et al* (2017) suggest that this dual approach may improve the accuracy of tube placement.

APPENDIX B: Oro/nasogastric tube flow chart for actions and decision-making, from NPSA guidance (2005)

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 www.dh.gov.uk).
Aspirate is pH 5.5 or below PROCEED TO FEED	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. ¹⁹ 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 CAUTION – STOP FEED: 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 IT IS IMPORTANT THAT STAFF FOLLOW THE FLOWCHART, RECORD THE OUTCOMES AND MAKE DECISIONS BASED ON THIS INFORMATION	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"> • is the baby on medication? • is the baby only 24 to 48 hours old? • is the tube in the same position as previously documented on an x-ray? • Is the visible length of the tube the same as previously documented? • what is the trend in pH values? • what is the volume of aspirate? 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 This is NOT a testing procedure	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.

Neonatal Services



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.