

Nasogastric Insertion: Confirmation of correct placement

A 6-year-old was admitted to a paediatric ward with a history of chronic faecal impaction for an inpatient bowel purge via a nasogastric tube (NGT). On arrival, the child's vital signs were between the flags. A NGT was inserted via the right nostril under sedation (oral Midazolam). Placement was confirmed via litmus paper and the "whoosh" test which involves rapidly injecting air via a syringe down an NGT while auscultating over the epigastrium. It was noted the child gagged and dry retched but kept the tube down.

No documentation was completed on how placement of the NGT was confirmed. At 10:00 hours the Glycoprep infusion was commenced at 50ml/hr via the NGT. This was increased to 150ml/hr at 12:05 hours as the child was tolerating the infusion. At 13:05 hours the child's oxygen saturations (SpO₂) were 94% in room air (Yellow zone). The child was assessed by a nurse who noted the child's chest was clear on auscultation, with good air entry and no signs of respiratory distress. The low SpO₂ was attributed to the dose of midazolam the child was given, pre insertion of the NGT. Continuous pulse oximetry was commenced.

One hour later the infusion was running at 200ml/hr via the NGT as per the local guideline. The nurse noted the child had a moist cough and was coughing up clear phlegm. The child's mother reported her son to have a cough that seemed to have increased since the insertion of the NGT. On assessment the child's chest was clear with good air entry bilaterally, and he had no signs of respiratory distress. His SpO₂ remained at 94% in room air with all other vital signs between the flags.

At 14:32 hours the child's SpO₂ were 92% on room air, and he was tachycardic and tachypnoeic. Despite being able to talk in full sentences, he looked pale and dusky. The NGT infusion was stopped, and a doctor was asked to review the child. Oxygen (4 litres) via a Hudson mask was applied which improved his SpO₂ to 100%.

At 14:42 hours a paediatric registrar reviewed the child and requested a chest x-ray which confirmed the NGT was in the child's left lung. The NGT was removed immediately. It was estimated that 400mL of Glycoprep had been infused. Open disclosure occurred with the mother.

Approximately 30 minutes later the child's SpO₂ dropped to 80% with 6 litres of oxygen, he developed respiratory distress, an expiratory grunt, tachycardia, and fevers. It was established the polyethylene glycol in the infusion had resulted in chemical pneumonitis. Due to an increasing oxygen requirement the child was commenced on high flow nasal prong oxygen and was transferred to a tertiary paediatric Intensive Care Unit. The child recovered and was discharged from hospital.

Lessons

The NSW Health Guideline *Infants and Children: Insertion and Confirmation of Placement of Nasogastric and Orogastic Tubes* ([GL2016_006](#)) is a best practice guide for clinicians to adhere to when inserting and confirming the placement of an NGT or orogastric tube (OGT) in an infant or child in the acute care setting. The following principles and lessons are outlined in the guideline.

Positive placement confirmation: It is critical to confirm the correct placement of an NGT or OGT prior to administering each feed and/or giving medication.

Tube misplacement can result in adverse patient outcomes including severe disability and death. These risks include:

- Pneumonitis from enteral feeds being deposited into the lungs
- Aspiration associated with tube dislodgement
- Trauma to surrounding tissues
- Pneumothorax
- Spontaneous passage of the tube through pylorus, causing feeding intolerances, abdominal pain, poor absorption of medications given via tube and diarrhoea.
- Intracranial insertion in infant/child with base of skull disruption.

A number of key recommendations are made in the NSW Health Guideline *Infants and Children: Insertion and Confirmation of Placement of Nasogastric and Orogastic Tubes* ([GL2016_006](#)) to reduce potential harm associated with incorrect placement of a NGT. These include:

- Replace litmus paper with narrow range pH paper (around 2.0 – 9.0) in minimum 0.5 increments

- Removal of litmus paper from all clinical areas and removal from the standard stores' orders. This is because litmus paper is not sufficiently sensitive to distinguish bronchial from gastric secretions and therefore **cannot** accurately confirm placement of the tube in the stomach
- Threshold for "positive placement confirmation" pH reduced to **4.0 or less**
- Consider medical imaging to check placement of tube if pH above 4.0
- Change to tube measurement using **Nose-ear-mid-umbilicus (NEMU)** instead of Nose ear xiphoid (NEX). Refer to the NSW Health Guideline *Infants and Children: Insertion and Confirmation of Placement of Nasogastric and Orogastric Tubes* ([GL2016_006](#)).
- Check exit-point mark at nose for signs of any tube migration.

The following techniques do **not** accurately confirm the correct placement of an NGT or OGT and **MUST NOT BE USED:**

- × Gas insufflation/auscultation ("whoosh" test)
- × Absence of respiratory distress
- × Litmus paper to test the acidity or alkalinity of aspirate.
- × Bubbling at the proximal end of the tube
- × Appearance of the feeding tube aspirate.

Initial drop in oxygen saturations: Midazolam has a rapid onset and a short half-life compared with other benzodiazepines. Its half-life in children over 12 months is reported to be 0.8 to 1.8 hours. The child's low oxygen saturations, 5 hours after administration were initially incorrectly attributed to the post effect of the midazolam.

Documentation: The investigation team found there was no documentation to support the correct placement of the NGT, with the only reference stating "established placement of tube in stomach". Documentation of the procedure in the patient's medical record is critical and must include:

- Informed verbal consent
- Pre and post insertion observations on the *Between the Flags* observation chart or form
- Tube type, size, date, aspirate amount, pH, and colour
- External length of the gastric tube at the nostril.

At risk children: Consider an x-ray to confirm placement of a NGT or OGT prior to use on all new insertions in 'at risk' infants or children. pH testing may give false negatives for initial confirmation of placement in the presence of acid suppression therapy. 'At risk' infants and children include those:

- On gastric acid inhibitors
- On gastric pump continuous feeds
- With diminished or absent gag reflex (e.g., children with developmental delay, neuromuscular disorders, bulimia)
- With an altered level of consciousness.

The NSW Health Guideline *Infants and Children: Insertion and Confirmation of Placement of Nasogastric and Orogastric Tubes* ([GL2016_006](#)) contains a Pre and Post procedure checklist which should be referred to prior to insertion of a NGT or OGT.

For more information on contraindications, insertion and confirmation of correct position and documentation of the procedure refer to the NSW Health Guideline *Infants and Children: Insertion and Confirmation of Placement of Nasogastric and Orogastric Tubes* ([GL2016_006](#)).

Skills in Paediatrics "SKIP" provides a multidisciplinary, interactive training resource to equip nursing and medical staff in NSW hospitals with skills and knowledge to safely insert a NGT. 'SKIP' can be accessed via [My Health Learning](#).

John Hunter Children's Hospital, paediatric education team have created a number of videos to demonstrate clinical skill including insertion of a NGT. These videos can be accessed via this [link](#).

References

Blumer, J.L. (1998). Clinical pharmacology of midazolam in infants and children. *Clinical Pharmacokinetics*, 35(1), 37-47. doi: 10.2165/00003088-199835010-00003

NSW Health. (2016). *Infants and Children Insertion and Confirmation of Placement of Nasogastric and Orogastric Tubes* (GL2016_006). Retrieved from https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/GL2016_006.pdf